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ABSTRACT

Designed to help in the development of an educational program about the value of rain forests, this handbook presents a condensation of issues, facts, and concepts. The handbook is divided into three parts. Part one introduces the rain forest ecosystem and provides conceptual background material needed in the determination of problems, the identification of causes, and the development of solutions. Part two examines the tropical rain forest from a regional perspective, describing how it functions and its values. Examples are presented of tropical rain forests in Thailand, Brazil, Indonesia, and Malaysia. Part three focuses on educational concerns and program options. Discussed are the role of environmental education in changing value systems, appeals for educators to teach the skills needed for change, and target groups and action plans. Several program options are presented for various target groups. (TW)

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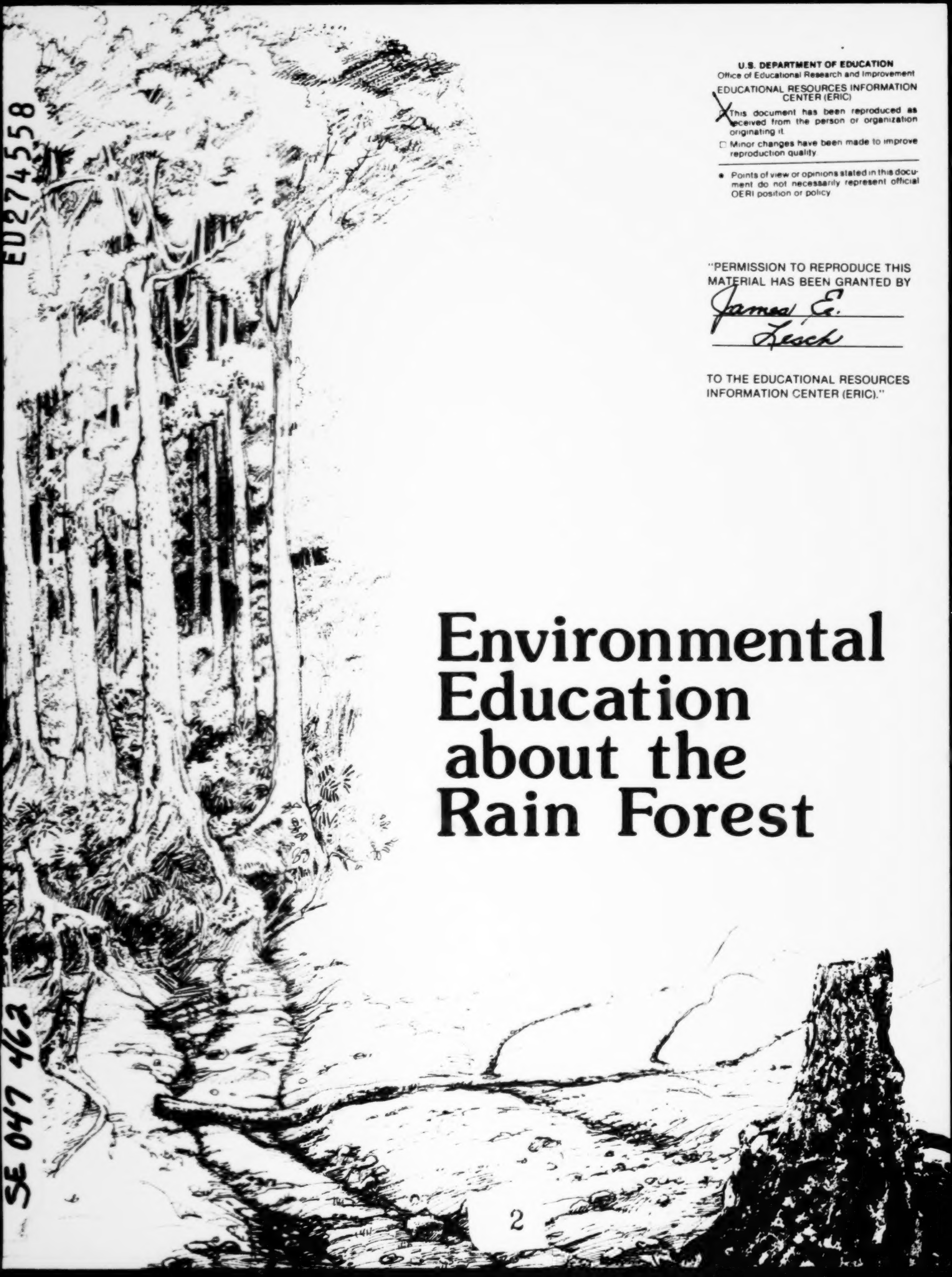

Environmental Education about the Rain Forest

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foreword

My latent interest in environmental issues turned into a vocation when I helped with setting up the Nature Education Center Khao Chong in southern Thailand. My qualifications then were enthusiasm, concern, and common sense, but I wish I would have had a publication to guide me through those first steps. Yet, none of the books I knew of had the right mix of facts, theory, and practical advice which makes sense to the generalist. Others will be in those same shoes I was in ten years ago, and I have written this handbook primarily for them.

acknowledgements

If the book turns out to be useful and readable, it is not the least due to the input of members of the Working Group on Rain Forest of the IUCN Commission on Education, and others who have contributed also. I am especially grateful to Lawrence Hamilton, Gerald Lieberman, Federico Pannier, Allen Putney, and John Smythe who had all spent much time and effort on improving the original draft.

J. Smythe's keen eye detected many a weak spot and his wry "is this a laborious way of saying that...?" led me to rewrite paragraphs of stilted academic prose. A. Putney reminded me of references to local needs which I might have otherwise omitted, and F.Pannier provided me with helpful suggestions and illustrative quotes. L. Hamilton saved me from embarrassment with his stern "it is utter nonsense" on a technical concern, and G. Lieberman supplied a number of Latin American case studies for use in the Spanish language version of the handbook.

The book also benefited from comments by Robert Beeton, Mario Boza, Herley Bowling, Harold Eidsvik, Yolanda Kakabadse, Gary Knamiller, Norman Myers, Bill Newmark, Federico Paredes, John Shores, Allen Whiting, and Tim Whitmore. Kiew Bong Heang sent me the material on Taman Negara in record time to beat a deadline. Carl Strom, with his sharp eye for detail, detected many superfluous or missing commas. Kenton Miller and Bill Stapp at the School of Natural Resources lent their advice at the early stages of the project, and Hernan Torres, I am told, is doing a fine job translating the book into Spanish.

The Wildland Management Center at the School of Natural Resources of the University of Michigan was my institutional home while I wrote the book. I greatly appreciated the use of the Center's office facilities and library and I am grateful to its director David Hales for taking care of administrative problems.

Introduction to the Handbook

Who is the book for ?

This handbook is for educators intending to teach the values of tropical moist forests. The material is most relevant for the educator in protected areas, but the tropical forest issues raised should make it interesting also for teachers and rural extension workers.

Why is education needed ?

Tropical rain forests are modified, destroyed, or converted in many parts of the world. Certainly the accessible ones will have to come under protection if we want them to escape further degradation and to continue to yield benefits for the public good.

Declaring a forest protected by law does not always save it. Law enforcement is failing in many places and innovative approaches to rain forest conservation are needed. Education holds promise as a management tool if it successfully reminds people that protective management of the rain forest is in their own best interest.

How is the book organised ?

The book is organized in three parts. Each part contains several sections which are briefly introduced on a cover page for each part.

rationale and purpose

The handbook has the overall purpose of helping the reader design an educational program which is based on critical thought from various perspectives, recognizing that people's attitudes and values are at least as relevant for education as factual knowledge.

The handbook presents in condensed fashion the issues, facts, and concepts which seem most relevant to education about the rain forest. The aim is to acquaint the reader with the essence of an issue, its relative importance, and the uncertainties and the conflicting viewpoints associated with it.

The handbook provides structure but not detail. The reader is encouraged to relate the material to a protected forest he is familiar with. Questions, suggestions, and exercises are hoped to motivate him to gather information from the local sources available to him and to explore local issues and concerns.

The skills and familiarity with the subject acquired in parts one and two together with the education specific themes of part three should enable the reader to develop feasible program options which address specific problems and target groups.

Introduction to the Handbook

How to use the handbook

The handbook can be a resource for the formal training of protected area educators or it can be a self-instructional guide for the educator already working in the field.

Many readers skip and skim and "pick the raisins from the cake". Skipping unfamiliar portions of parts one and two, however, could leave the learner ill prepared for program design in part three.

It is important that the theory in the handbook be applied to the real world. Trainees should focus attention on a well-defined site, preferably the area where they will work after completion of the training. It should be understood from the beginning that the main purpose of the training is to produce feasible program options.

This applied focus has several advantages. The learner can build on past experience and knowledge of his area. He is motivated by the expectation of having a useful product to show at the end, and he participates actively in the learning process if he relates the theory of the book to actual conditions on the site.

To reinforce learning and improve retention, this process expects the learner throughout to react to the material, do exercises and answer questions often on the basis of sparse information. The limitations should be obvious and lead the reader to ask additional questions which he should try to answer by examining the relevant aspects on his site.

Instructors in formal training are encouraged to conduct field trips and set aside time for group discussions so that participants can profit from each others' experience.

The necessity to acquire or improve skills will become obvious as ideas for programs consolidate. Because of the limited scope of this handbook, we must leave this vast subject to the initiative of the instructor or the individual reader.

As a result of the training (or self-instruction), the learner should begin to develop ideas into program options. Careful scrutiny of the drafts and revisions are highly recommended as trainees are expected to submit the program options for funding and quite likely see them through implementation.

Introduction to the Handbook

What is in it for me ?

The readers of this book are themselves best able to judge what of the material is relevant and useful in their situation. The indicators listed below should therefore not be taken as a standard of knowledge and skills against which to measure progress, but as a summary of the tangible results one may expect from studying each part.

Part One

At the end of part one, the reader should be able to make an informed judgement about the seriousness of deforestation in his area of concern. He should be able to name the major causes, pinpoint affected locations, and cite contributing factors which aggravate the situation or prevent solutions. The reader should begin to judge conversion of rain forest to non-forest land uses by weighing three factors: sustainability of the new use, possible consequences of the conversion, and the purpose and beneficiaries of the new use.

Part Two

The reader should finish part two with a thorough understanding of how systems work and should be able to apply the knowledge to his area of concern, e.g. identify the major natural and social systems of the region, understand how the rain forest ecosystem functions, where it is vulnerable, and how it is linked to other systems.

He should have collected, or know where to obtain, reference materials about the rain forest and maps and data about the physical environment. He should be able to analyze the protected forest based on a given outline. Aware of rain forest values, he should be able to discuss or write a paper about the role of the forest in the regional economy, possibly with a description of conflicts of interests and documented effects of development projects or deforestation.

Part Three

Having completed part three, the reader should know the main characteristics and rationale of environmental and values education and be able to consciously incorporate learning domains into program design. He should be able to determine obstacles to management objectives of the protected forest and define the target group responsible for, or able to remove, them. He should also be able to formulate solutions through education and present them in the form of concise and convincing program options of varying complexity.

Part Three should help the reader answer questions like these:

- What is environmental education?
- How can you use the material provided and the protected area to develop education programs for local groups?
- Which groups do you think are most feasible to reach and work with?
- What are the main management objectives of the protected area and what types of programs can you design to help achieve them?
- How will you evaluate the effectiveness of your programs?

What to find where

Each page has a wide column on the inside and a narrow column on the outside.

The main text is in the wide column.

Check the narrow column for a quick overview of the material on the page. Questions and key-words refer to the text next to them. Abbreviated answers are given in this column unless already highlighted in the text. It also accommodates definitions and small graphics and illustrations.

Section titles are printed on top of each page.

Many sections have a summary and most conclude with suggestions on how to apply or practise what has been learned.

Stories, case studies, quotes, descriptions, or questions printed in italics illustrate points made in the section.

Text framed like this complements the main text or elaborates on specific points.

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use of the male/female gender

My use of the male gender when referring to educators is as much a habit as it is motivated by the desire to avoid the awkward "he or she". It is not to imply in any way that women educators are not just as capable or suitable.

Table of Contents

Part One introduces the rain forest ecosystem and provides the conceptual background material (e.g. popular explanations for forest destruction) necessary to determine problems, identify causes, and develop solutions.

Part Two is mainly about the tropical rain forest ecosystem in a regional setting, explaining how it functions and what it is valued for. It discusses information needs and presents some real-world examples for tropical rain forest values.

Part Three focuses on educational aspects and program design. Defining problems and target groups and developing program options are other major subjects.

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Part One

Global Perspectives and Conceptual Background

Introduction to the Rain Forest

pages 3-7 A preliminary look at the rain forest and the values associated with it.

Tropical Rain Forests are a Global Resource

pages 9-11 Definition of tropical moist forest, estimation of area, and worldwide importance.

Rain Forest Destruction – a Global and Local Concern

pages 12-15 Causes and rates of destruction.

Explanations for Rain Forest Destruction

pages 16-19 Common and sometimes competing explanations.

Think Globally, Act Locally

pages 20-26 The role of global thinking in recognizing values, informed decision making, discovering relationships, and problem solving.

Values and Value Systems

pages 27-32 Types of values and how they are supported or rejected by value systems.

Misconceptions about the Rain Forests (p.8)
When is a forest no longer a forest?
 The Gradient from Forest to Non-Forest (p.10)
How long is this rubber band?
 The concept of sustainability is flexible. (p.25)

Introduction to the Rain Forest

It is easy, without a perception of the whole, to lose sight of the forest because of the trees. Disregarding for now hard facts and scientific detail, let us take a preliminary look at the rain forest and the values associated with it.

A forest is more than the sum of its trees.

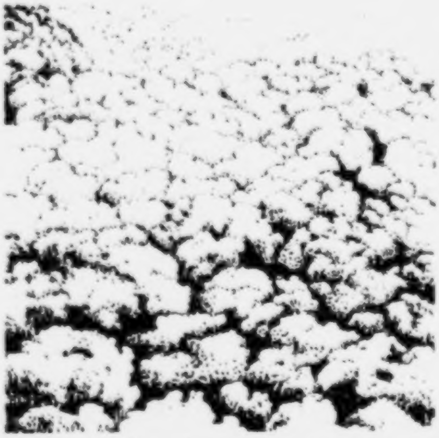
The tropical rain forests have been evolving for more than 30 million years. These forests may all look alike but each region and locality has developed its own unique assemblage of interdependent organisms. Their variety is bewildering and appearance often bizarre, but their forms and behaviour are all adjusted to life in this forest. Together they create a unique environment, the world of the tropical rain forest.

The rain forest is home to as many as half of the world's animal and plant species. Many of them are highly specialized, and if one species becomes extinct, others may not be able to take over all of its functions, with consequences that we cannot foresee.

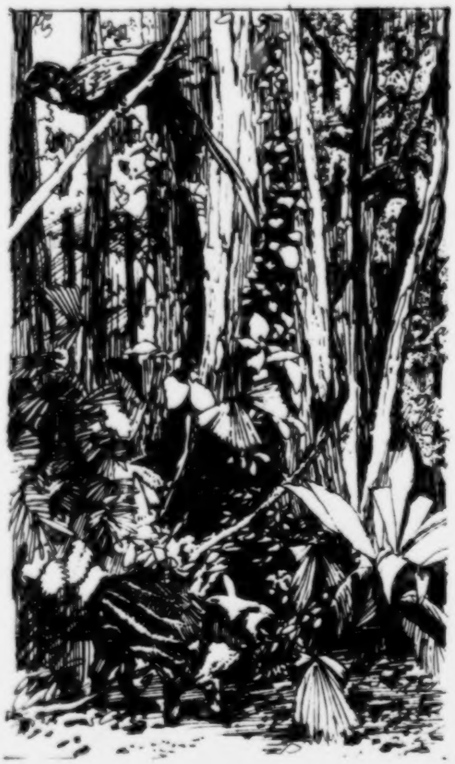
The world of the rain forest extends from about one meter below ground to about sixty meters above ground. Above, the umbrella crowns of the towering and straight boled forest giants are widely spaced. Some ten meters below the giants, an unbroken layer of tree tops (canopy) of lesser or emerging giants spreads as far as the eye can see. They are the privileged consumers of sunlight, but at a price.

The seeds of many species lie dormant in the deep shade of the forest and may never germinate. If they do, the seedlings barely grow until another tree comes crashing down, opening the sky to the waiting sapling, which now enters the race towards the light.

In the layer below, the more shade tolerant trees catch whatever diffuse sunlight the taller trees let through. Vines, orchids, and tree ferns festoon the space between, and every nook, cranny, and niche is occupied with something that grows.



An unbroken layer of tree tops spreads as far as the eye can see.



Every nook, cranny, and niche is occupied with something that grows.

And yet, the rain forest is not menacing, gloomy, and foreboding, as it is often made out to be. The eye quickly adjusts to the relative darkness, it is cool in the shade, and walking on trails is quite comfortable.

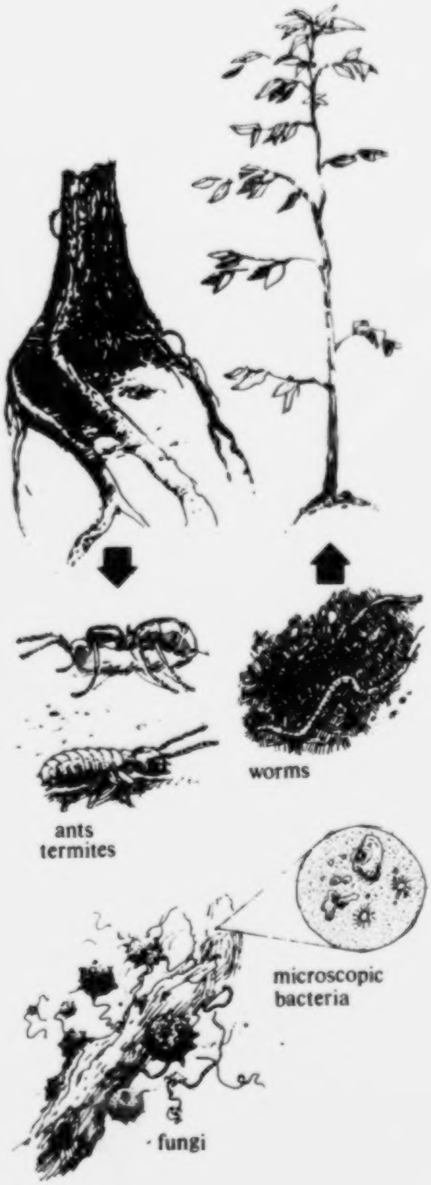
Waste is the cardinal sin in the rain forest. Closer to the forest floor, sunlight becomes an increasingly scarce commodity. Plants have adapted by positioning their leaves in the most efficient way or by adjusting their rate of growth to the amount of light available. Plant nutrients are in short supply and tend to escape with the water which inexorably follows the pull of gravity. But what one creature lets inadvertently slip by, another is ready to catch.

The inherent natural recycling of scarce resources is the real secret of the rain forest. If there is one thing that humanity can discover in the rain forest's exuberant growth, it is the importance of this natural recycling.

The mighty tiger is at the top of the food chain from plant to herbivore to carnivore. Mighty or not, he will die one day, like you and me, and return to the soil. Immediately the recyclers of the rain forest will go to work on the carcass and in a few days little more than bones will mark the place where it lay.

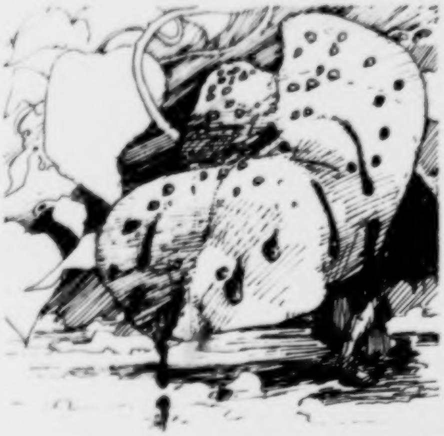
Scavengers and detritivores reduce large pieces to tiny morsels. Champion among them is probably the termite because it riddles all but the most resistant logs with meandering paths and hidden passages through which air, moisture, and yet smaller organisms, fungi, and micro-organisms obtain access. The termite's labour is only rewarded because of the flagellates in its intestines which, for free room and board, help it digest the cellulose of the woody tissue.

If a prize were awarded to the most industrious and essential creatures of the rain forest, it would probably go to the insects, the fungi, the microbes. The mites and other minute decomposers are vital links in the eternal cycle of death and rebirth. When death has thrown the basic building blocks of living matter into disarray, detritivores and decomposers are the first actors in a chain of events which reorganize and reassemble them into living organisms.



Decomposers are vital links in the eternal cycle of death and rebirth.

Water is abundant in the tropical moist forest environment. Tropical thunderstorms and heavy monsoon rains unleash kinetic energy equivalent to plowing a field several times over. The energy dissipates, courtesy of the rain forest, in the several storeys of tree crowns, and rainwater finally reaches the forest floor as a mild drop and trickle, unable to dislodge the soil particles. It is thanks to the rain forest cover that there is soil at all.



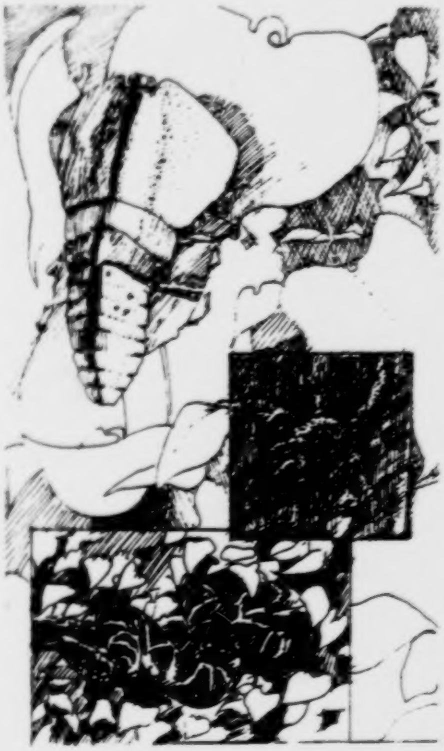
Most rainwater finally reaches the forest floor as a mild drop and trickle.

Rainwater percolating down to the groundwater washes out any nutrients that remain in the soil for too long. Nutrients freed by decomposition of organic matter must therefore be quickly taken up by the living plants so that little slips through the thick root mat in the topsoil to be lost.

Except for green, colour is rarely seen in the rain forest. A blooming orchid high up in a tree, the cap of a mushroom, the metallic sheen of a bird's plumage, or the bright warning orange of a poisonous tree frog are lit up by an occasional ray of light. To us colours are beautiful, to the creature they may be essential. Colour keeps the frog from being eaten, by advertising that it is poisonous.

Where some creatures advertise, others blend in with their surroundings. A butterfly flashes red dots as it flutters its unpredictable dance above the forest floor. It vanishes all of a sudden. Closer inspection reveals that it has apparently turned into a mottled rotting leaf that curiously stands on its edge. Nearby, a bright green and incredibly noisy leaf suddenly spreads wings whose owner turns out to be a katydid with jaws strong enough to draw blood if you try to catch it.

To us mimicry and camouflage of rain forest creatures are a never ending source of wonder and amazement. To the animals they are essential adaptations and behaviours.

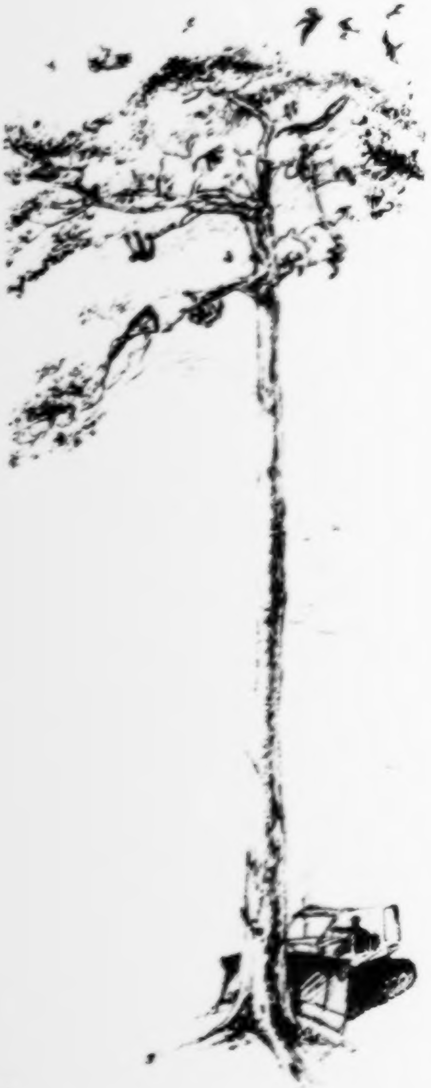


Mimicry and camouflage are essential adaptations.

Frog concerts follow the first heavy rain after a dry spell and seasonally the din of the cicadas penetrates the forest. Most of the time noises are intermittent and depend on the time of day. There are screeches and squawks, howls and roars, piercing screams and barks, but also the faint murmur of a brook and - silence.

For its inhabitants to survive, the rain forest ecosystem must be kept in working order.

To us noises may sound frightening and trigger a rush of adrenalin, or they may be pleasant to listen to. For the animal which utters or otherwise produces them, they have meaning. They announce presence, they attract mates, or sound warnings. Everything that happens in the rain forest has meaning for the individual species and the community as a whole. While each species goes its own way, together they are tied into the larger web of life of the rain forest.



Those who are not at home in the rain forest tend to exploit it without regard to its functions.

It is this web, the complexity, the interrelatedness, and the interdependence of rain forest organisms which humans so often ignore, oblivious even to the mere fact that it does exist.

The wasp and the fig tree are part of the web. The wasp which sucks nectar from the fig tree flower is unaware that neither wind, bird, bat, nor any other insect except itself is equipped to pollinate the fig tree species.

Months later, the fig tree may be the only fruiting tree for many miles around, with deer, pigs, leaf monkeys, macaques, gibbons, civets and binturongs, hornbills and barbets all flocking to it.

One of them will later drop a seed in just the right place, in the moist leaf mold of a cavity high up in one of the forest giants. There the seed will germinate and send its long thin roots down to the ground, grow thicker, mature, flower, and exude nectar for the wasp's descendants.

The existence of the rain forest species depends on the continued existence of the forest, and for them the value of the rain forest is inherent in the mechanisms which maintain the ecosystem in working order. Those who are not at home in the rain forest are apt to exploit it without regard to the organization and functions of the system.

Learning about the values of the rain forest is learning how to use it and keep it intact at the same time. To that end, the protected area educator teaches people how to make value judgements and decisions based on physical and biological principles as well as ethical/moral considerations.

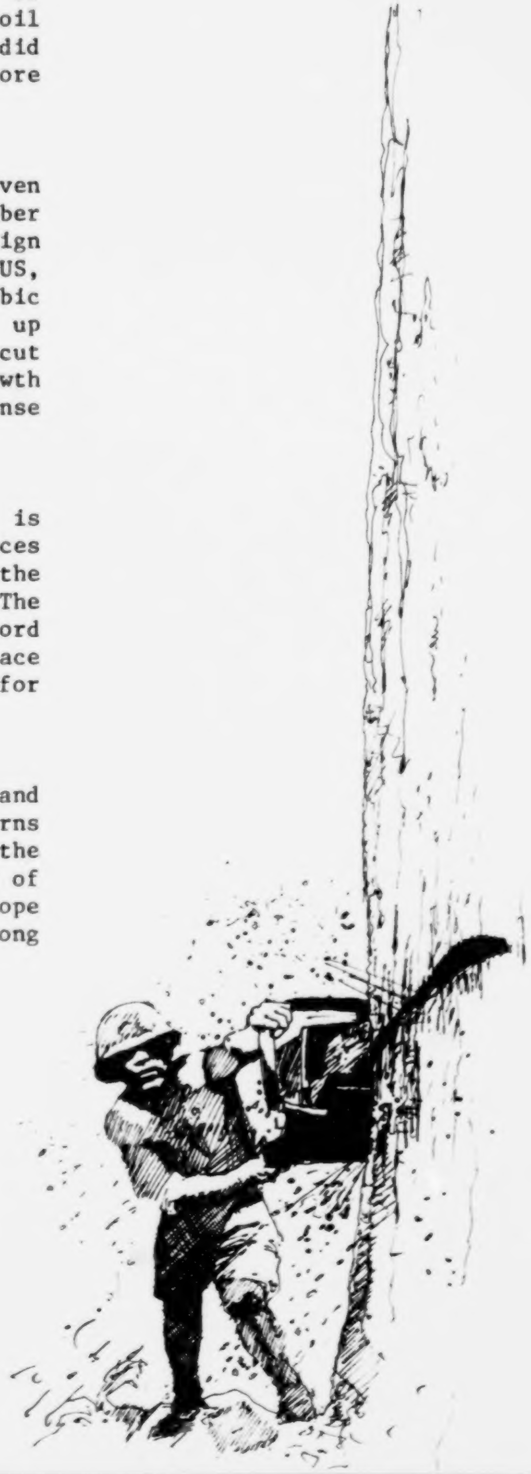
Introduction to the Rain Forest

Historically the tropical forest was considered worth no more than the value of its timber, its forest products, or the land it grew on. The questions of sustainable use and the values of watershed and soil protection, of species survival and recreation did not arise because there always seemed to be more forest within reach.

The tropical forests yield hardwoods valued at seven billion US dollars per year, and tropical timber exports contribute significantly to the foreign exchange earnings of a number of countries. The US, Japan, and Western Europe buy some 66 million cubic meters (cu.m.) of tropical hardwoods annually, up from about 4 million thirty years ago. Much is cut but little is replanted and so the miraculous growth of timber exports was achieved largely at the expense of diminishing the growing stock.

The formerly vast reservoir of tropical forest is shrinking fast. Local depletion and rising prices place firewood and construction timber outside the physical and financial reach of many of the poor. The shortage may not be apparent to those who can afford the price but they, too, will eventually have to face the consequences of exploitation without regard for the future.

As timber-exporting nations become importers and local shortages become acute, short-term gain turns into long-term pain. If education can convey the multiple values of the forest and the advantages of management for sustainable yield, there is yet hope that people will submit to short term pain for long term gain.



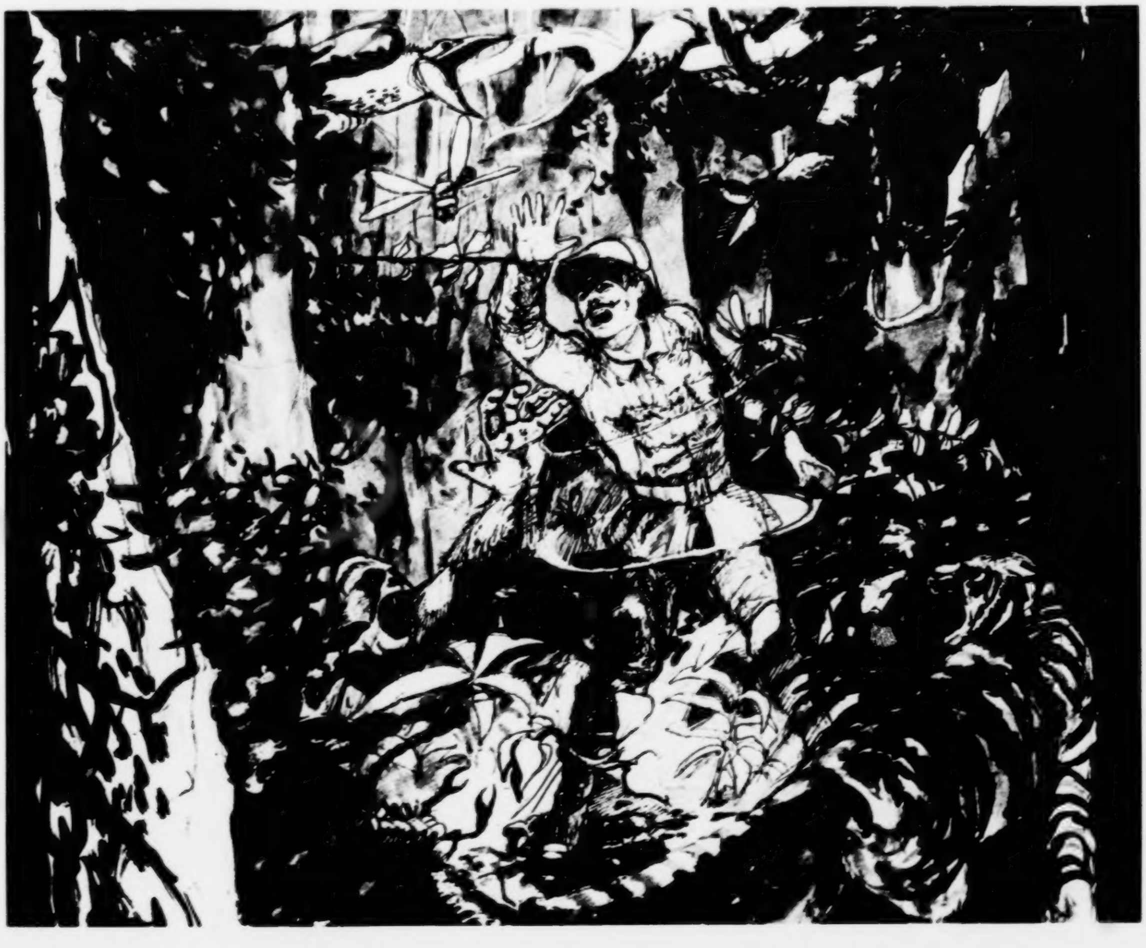
Is the tropical rain forest worth no more than the price of its timber?

Misconceptions about the Rain Forest

Misconceptions about the tropical rain forest are widespread, particularly in the temperate regions where the lurid tales of travellers, adventurers, and colonists have created the myth of the "green hell". Printed in italics is a sample written by one Algot Lange who travelled the Peru/ Brazilian border area in the year 1910.

The inconvenience of travelling in these regions may have inspired such reports, but they hardly reflect the truth. You, the educator, can take people out and show them reality.

I saw myself and my companions engulfed in a sea of poisonous green, caught by living creepers that dragged us down and held us in a deadly octopus embrace. The forest was something from which I fled; it was hideous, a trap, with its impenetrable wall of vegetation, its dark shadows, and moist, treacherous ground. I longed for the open; struggled for it, as the swimmer struggles up for air to escape from the insidious sucking of the undertow.



Tropical Rain Forests are a Global Resource

"Tropical moist forest" is a generic term for forests in the humid tropics where temperatures and rainfall are high and the dry season is short.

We are concerned with two main types of tropical moist forests:

- Tropical Moist Deciduous Forest
  annual rainfall above 1500 mm
  dry season 2-3 months
  (often called "monsoon forest")
- Tropical Moist Evergreen Forest
  annual rainfall above 2000 mm
  dry season shorter than 2 months
  (often called "rain forest")

Sometimes the adjectives "montane", "highland" or "hill", and "lowland" are used to distinguish different types at different altitudes.

Scientific terminology and classification of forest types is more complicated than this, but the above broad definitions are satisfactory for our purposes.

Because the term Tropical Rain Forest (TRF) is most common it will be used in the handbook with the understanding that it is synonymous with tropical moist forest as defined above.

What do we mean by "Tropical Moist Forest" ?

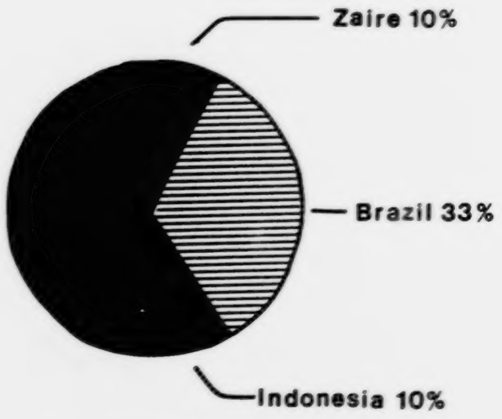
Tropical Moist Deciduous F.
Monsoon Forest
Tropical Moist Evergreen F.
Tropical Wet Evergreen F.
Tropical Rain Forest

The bulk of the existing rain forest is in relatively few countries but it is impossible to establish worldwide TRF area with accuracy because figures are often unreliable and definitions of what constitutes forest cover differ from study to study.

Forestry data from many countries are unreliable. Zaire, for example, has about one tenth of the world's TRF and, yet, its forest cover is reported with only a plus/minus 40% accuracy.

An accurate assessment of TRF area is further complicated by different opinions on what should or should not qualify as forest (see box on page 10). Someone who values the forest for its beauty or as a source of genetic resources obviously applies different criteria from someone who looks mainly at its logging potential.

estimate of worldwide TRF cover



Tropical Rain Forests are a Global Resource

What constitutes forest is open to different interpretations.

Much of the confusion over conflicting figures on forest cover stems from slightly different concepts of what still constitutes a functioning forest ecosystem. A severely disturbed TRF could still adequately serve the firewood needs of the local people while being modified to the extent that it could never return to its former condition.

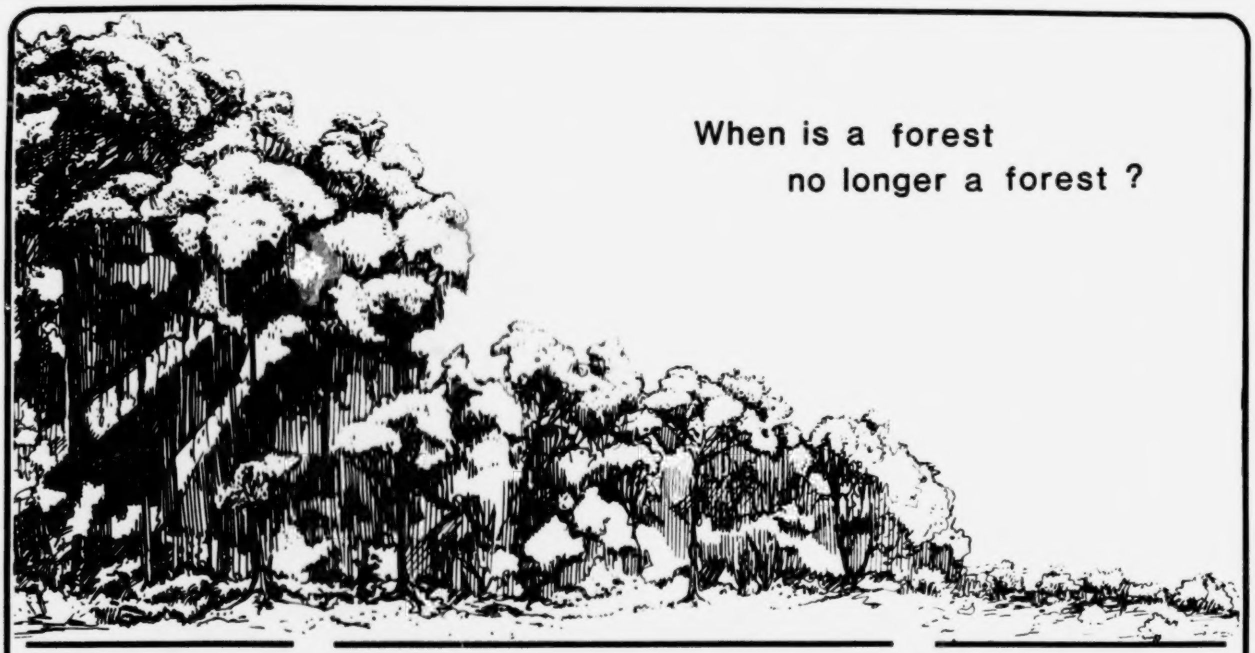
approximation of forest cover

FAO= Food and Agriculture Organization of the United Nations

UNEP= United Nations Environment Programme

The 1982 FAO/UNEP figures probably constitute the best approximation currently available. This estimate is based on the most recent data and distinguishes open and closed forests as well as the types and extent of disturbance they are subjected to.

The term "closed forest" refers to a forest whose tree crowns cover all or most of the ground. In the tropics broadleaved closed forest largely coincides with the tropical rain forest as defined on page 9.



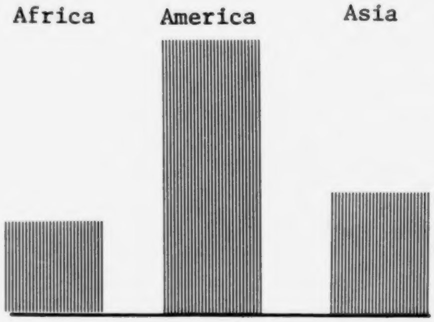
When is a forest no longer a forest ?

clearly a forest	**Still has trees and looks green, but some of its functions are impaired.**	**clearly not a forest**
A forest can be ...	A forest can be ...	A forest can be ...
virgin, primary, prime, untouched, or undisturbed.	modified, severely disturbed, degraded, secondary, altered, alienated, logged, deteriorated, clear cut and replanted.	radically altered, converted, lost, or destroyed.

Tropical Rain Forests are a Global Resource

The FAO/UNEP report puts world area of closed broadleaved forest in 1980 at 11.6 million square kilometers (sq.km.). Of this total, mangrove forest accounts for 155,000 sq.km. or less than one percent.

With 56% of the total, tropical America has the largest share of the world's rain forest. It is followed by tropical Asia with 25% and tropical Africa with 18%.



Why are TRFs a global resource ?

There are several good reasons why people all over the world have a stake in preserving the rain forest.

resource for indigenous people

- TRFs are an important cultural and economic resource for indigenous societies whose cultures tend to disintegrate when the forest disappears.

soil protection

- TRFs protect fragile soils in the drainage basins of such major river systems as the Amazon, Congo, and Mekhong.

influence on climate

- Differential heating and evapotranspiration from large TRF areas affect air movement and humidity, and influence the regional and global climate.

effect on yield of fisheries and agricultural crops

- Forest cover in the watershed prevents soil erosion and equalizes waterflow. Drastic reductions in TRF cover are likely to have repercussions on marine and freshwater fisheries and on crop yields even in regions far away from where deforestation took place.

common heritage and genetic resources

- The TRFs contain as many as half of the earth's plant and animal species. This vast reservoir of genetic material has yielded tangible benefits and will continue to do so in the future.

suggestions

Try to assess your own country's share of global TRFs by answering these questions.

- ■ Are there any recent figures on forest cover? If yes, what type and quality of forest are listed as actual forest cover?
- ■ How reliable do you think the figures are?
- ■ Do TRFs in your country cover significant portions of the drainage basins of major river systems?

TRF Destruction - a Global and Local Concern

Destruction in this context is taken to mean outright loss as well as modification which seriously impairs ecosystem functions.

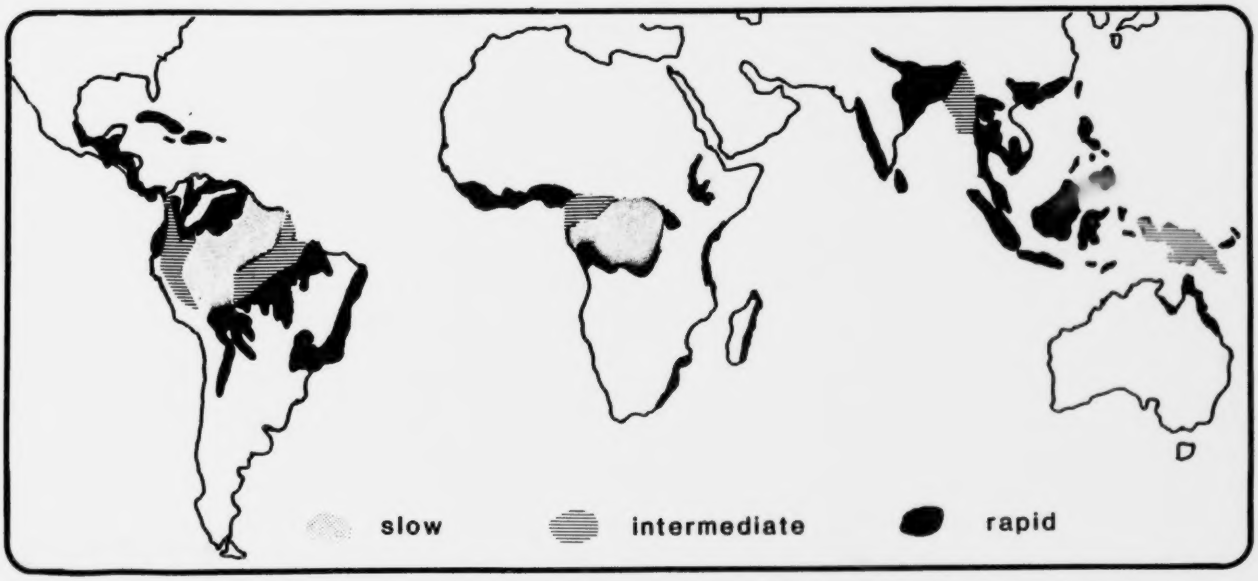
immediate causes and rate of destruction

Forests seldom disappear overnight. They are invaded, good timber trees are removed, patches are cleared progressively until a few years later only scraggly tufts of trees remain on hill tops, too little to still call the area forested. Immediate and underlying causes are discussed in this and later sections.

Roads into undisturbed forests are constructed by governments and logging companies. They consume prime forest when opening up previously inaccessible regions, and settlers soon follow to plant crops on the former forest soil.

Deforestation in the tropics is attributed to logging and subsequent settlement, to shifting cultivation, to firewood cutting, to road construction and to clearing for cattle grazing. Estimates of annual deforestation range from 60,000 to 250,000 sq.km. per year depending on the investigator's assumptions, data, and definition of what constitutes forest.

It is uncertain whether worldwide the rate of destruction is increasing, stable, or decreasing. It seems certain however that it is fast enough to be a problem in many parts of the world and disastrous in some regions.



Regions with rapid, intermediate, and slow rate of destruction. (source: Myers)

The FAO/UNEP report estimates that an area of about 71,000 sq.km. of tropical closed broadleaved forest is cleared annually and that the worldwide deforestation rate stands at just over 0.6%, with only minor differences among the continents. This is, of course, only an average, and the rates range from as low as 0.2% per year in the Congo/Cameroon basin to over 1% for Madagascar.

But even at low national rates, deforestation can be a serious problem locally or regionally. Speculating about exact rates of destruction is rather unproductive. More important is to find out where the problem is most urgent and where we have to act fast.

In Africa shifting cultivation (see p.58) affects almost 30% of the closed forest area and is thought to cause 70% of deforestation.

In Asia 23% of the closed forest area is affected by shifting cultivation which is estimated to cause almost half of all deforestation there.

In America only 16% of the closed forest area is affected by shifting cultivation which is thought to cause about 35% of deforestation. Clearing for cattle ranching is another major cause on this continent.

global concerns and consequences

Changes in weather patterns

Scientists have voiced concern over the possibility that global rain forest destruction will adversely affect global atmospheric circulation and weather patterns.

Water vapour rises from the evaporating surfaces of lakes, oceans, and wetlands. It condenses into clouds and falls again as rain (or snow) in a continuous global cycle. Tropical rain forests are also important sources of atmospheric humidity because more than half the rain that falls on them evaporates again.

Because of their high moisture content, forests also heat up more slowly and cool more slowly than bare ground and thus affect atmospheric circulation as warm air rises and cool air sinks.

How serious the threat is we cannot tell because, even now, weather and climate are only imperfectly understood. Regional and global trends would have to be monitored over many years and, even then, it would be difficult to separate "natural" trends from those caused by deforestation.

global warming trend (greenhouse effect)

The term "greenhouse effect" refers to a warming of the atmosphere. This is due to an increase in the carbon dioxide in the air because the gas reflects heat which would otherwise have been radiated out into space.

If observed trends continue, they could dramatically alter global weather patterns and melt the edges of the polar ice caps, raise the water level in the oceans and inundate the fringes of the continents.

The burning of TRF, but also of coal and oil, releases carbon dioxide into the air and, once it has been cleared and burned, only gradually removes the carbon from the air again as it regrows.

Carbon is stored in the atmosphere, on land, in the oceans, in sediment, and in bedrock. Too little is known about the transfers between them to predict global warming trends and attribute them unequivocally to TRF destruction or any other cause, but neither can the possibility be dismissed out of hand.

species extinction

The concentration of a multitude of plant and animal species in a small space is one of the remarkable characteristics of the tropical rain forest.

Highly specialized and interdependent, most TRF species cannot adjust to a severe disturbance of their habitat. To a tree frog, for example, a dusty logging road is an insurmountable barrier. The majority of its bird and mammal species perish when a rain forest is cleared.

Loss of habitat is the more pervasive and ultimately more final threat to wildlife than hunting or trapping. We may still have a chance to save such large and impressive species as the gorilla or the orangutan from the poacher, but only if their habitat is left intact.

More serious than the loss of single species is the extinction of an assembly of species, of species which we may not even know exist and which could be of untold value in the future. However, species are almost certain to become extinct when large areas of TRF are cleared.

A deep seated feeling of reverence for all forms of life permeates most cultures and religions, although this does not always sufficiently influence behaviour. Species are, figuratively speaking, the property of humankind, and extinction represents a tragic and irreversible loss to all of us.

local concerns and consequences

On the local level, forest destruction has physical and social repercussions which are easily overlooked if one is preoccupied with global concerns or rapid modernization.

Locally and regionally, the forest may be an essential component of traditional cultures and economies to an extent unappreciated by outsiders (see pages 64,65,67). Deprived of the forest and its resources, the people may lose their economic independence and much of their cultural identity. Economic development and the adoption of modern production systems does not necessarily substitute for all of the former functions of the forest, and where the transition is too rapid the change is traumatic and disadvantageous to the local people.

The detrimental effects of deforestation on hydrology and soils are local problems long before they ever turn into national or international concerns. Unfortunately, officials tend to ignore early warning signs. An isolated landslide, which could have been prevented by reafforestation, is registered as an unfortunate act of God in the district office.

Administrators and politicians neglect local resource shortages and deterioration, assuming that economic development would solve the problems in due course. They tend to favour modern production systems over traditional ones even where this is not in the interest of their local constituency. Thus, deforestation might be recognized as a problem if it threatens the supplies of a modern wood-processing industry, but not if the manufacturers of wicker furniture in the villages are short of rattan.

Concerned citizens who recognize the global threats of forest destruction increasingly call for strict protection of forest resources but, without regard to legitimate local needs, access to resources is barred and the seeds for social conflict are sown. A more enlightened approach would aim at protective management which explicitly recognizes local needs.

suggestions

Try to assess the impact of deforestation in your area by answering some questions.

- Have any TRF plant or animal species become extinct or nearly extinct in your country or region? Can you find out more about the circumstances under which they became extinct?
- What has been the impact of forest destruction on local populations? Are there any case studies?

Do you fully support this statement?

If it wasn't for rapid population growth and the destructive practise of shifting cultivation, TRF destruction would not be a problem.

True, population growth and shifting cultivation are major factors in TRF modification, but this does not mean that without them it would not be a problem. They may constitute overriding factors in one area, but be non-existent in another.

An educator should make an assessment of the causes of deforestation in his region. We all have favourite explanations for phenomena in the world around us, but these need not close our minds to other possible explanations.

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popular explanations

Let us now take a look at some explanations for deforestation.

population growth

Population growth rates in TRF countries are among the highest in the world. From this, some people conclude that doubling the population also doubles the impact on the forest.

But exactly how much deforestation is due to population growth? The way in which people use natural resources, their consumption habits, timber exports, and imported technology may offer better explanations than population size.

The export of tropical hardwoods to Japan, Europe, and the USA, for example, has become a seven billion dollar per year business. The use of heavy machinery adds to the destruction, damaging up to 75% of the canopy in order to gain access to and fell the few and widely scattered marketable trees. Since 1950 timber exports from TRF countries increased fifteen times, much more than their population increased during that time.

rising expectations

The farmer who clears an additional patch of forest this year may do so not to feed another mouth, but to pay the monthly installments for a motorcycle or to send his children to school in town. In this case rising expectations are behind deforestation.

Roads and radio open the countryside to urban influences. Sons and daughters who migrated to the city bring urban values to the village. Advertising is pervasive and persuasive.

Explanations for Rain Forest Destruction

The convenience and status that money can buy are often valued more than the benefits received from a standing forest. As a result forests are cleared and planted with cash crops or converted to pasture to raise cattle for beef export.

Rising expectations are closely associated with life-styles and societal value systems (see p.79). The question of what constitutes reasonable expectations and life-styles cannot be answered here, but the important question of values and societal value systems will be taken up again in the following section.

rural poverty/social injustice

The argument says that poor people are forced into clearing forests because they have no land of their own or they cannot find other work which would support them and their families.

Where this is a serious problem, it may lead the educator to question public policy. If rural development, land reform, and the creation of jobs have low priority in public policy, the government must take some blame for deforestation.

wasteful resource use

Rural societies are often regarded as ignorant and wasteful in their treatment of forest resources.

Rural societies which make regular use of the rain forest include hunter/gatherers, stable agricultural communities, or migrants newly settled in or near the rain forest.

Of these, only the migrants coping with an unfamiliar environment can be said to use unsuitable and therefore wasteful cultivation practises. The hunter/gatherers have evolved biologically and culturally alongside the forest and can hardly be called wasteful resource users.

Traditional agricultural communities supplement their agricultural produce with forest goods or practise a refined and sustainable form of shifting cultivation (see p. 58). They may modify the forest but leave it functioning as a system.

As a rule, the subsistence economies of traditional, rural societies make efficient use of their renewable resources, not the least because limitations of primitive technology and cultural taboos prevent overexploitation.

The natives of the Indonesian island of Siberut need to work only the equivalent of 22 days per year to harvest the Sago palm and prepare their staple flour from it. They consider every tree inhabited by a soul, and a tree is felled only after ceremonial apology for the damage that might be done.

Outside influence often turns traditional use into wasteful use. Hunting with the blow gun for personal consumption becomes market hunting with a shot gun. The Durian tree is an important food source for the native people. It takes a newly planted tree ten years to bear a full harvest of fruit. Commercial loggers cut down Durian trees although the market value of the fruit over the period it takes to grow a replacement exceeds the timber value of the tree.

lack of economic development

If economic development were satisfactory, some people say, a growing economy would produce substitutes for goods now obtained from the forest. People now living off the forest would find alternative employment and build their houses with bricks and corrugated iron instead of wood and thatch.

While there is some truth in this argument, one should know that economic growth can be accompanied by high unemployment, that it may displace people, and that it intensifies the demand for industrial uses of forest resources.

The benefits of economic growth could be directed toward slowing deforestation but economic growth does not ensure improvement.

Even where high economic growth rates have been achieved in developing countries, for example Brazil, many or most of the people still live at subsistence. At the same time, development reduces the productivity of or access to subsistence resources (p.64/65).

inadequate planning and management

Administrators and managers often contend that good planning with the power to implement the plans would leave the rain forest intact where it needs to be intact and exploit it where it is in society's best interest to do so. Some foreign aid agencies and planners subscribe to this view.

Better planning could improve the situation and this handbook is intended to improve a certain kind of planning. But plans have their limitations. They are the less reliable the further they project into the future, and may require control which is either impossible to achieve or which is perceived as oppressive.

Deciding where to exploit the rain forest and where to leave it alone is easier said than done, as you will find out in the land-use exercise on page 48. Also, planners are not infallible, and, like the rest of us, have biases and prejudices reflecting their social class and upbringing.

inadequate law enforcement

Lack of law enforcement is one of the most frequent arguments given to explain why TRFs under some form of legal protection are still not safe from disturbance. Because it promises immediate results, it is often considered the best solution to encroachment.

In practise one often finds that the enforcement of logging regulations or trespassing laws is ineffective and expensive. In cases where law enforcement is vigorous and effective, it often results in conflict with the local people and makes cooperation between them and the authorities difficult if not impossible.

lack of awareness

If people are not aware of a problem, they have no reason for seeking change. The implication is that awareness will lead to change. Unfortunately, this false conclusion can lead to much frustration and disappointment on part of the educator.

People look at new ideas with suspicion. They will, however, change old habits and accustomed practise if this is obviously to their advantage. If the proposed change is promoted as for the common good but associated with inconvenience and sacrifice, the argument alone is not enough, and further incentives are needed to convince and persuade.

Education to increase awareness of the effects of forest destruction should therefore be accompanied by additional efforts to achieve the desired change.

suggestions

More than one of the above explanations are likely to apply to your area. Try to rank them from very important to also important and use your knowledge of the area to come up with different explanations and examples. Additional explanations often surface if you ask "why" questions such as "Why does law enforcement not seem to work?".

global and non-global thinking

Imagine the following (fictitious) situation:

The National Parks and Tourism Department of a Latin American country hires the foreign consultant Morgan Swiftlet to investigate problems of the Alto Arbro Wildlife Refuge. They ask him to state causes, possible consequences, and to give recommendations.

Here is a summary of what Morgan Swiftlet writes.

Alto Arbro is one of the three remaining locations in the nation where the endangered woolly bat-eater still occurs in a viable population. The species is extremely sensitive to disturbance and has withdrawn into the most remote stands of climax rain forest in the refuge.

Trapping by local people for the live animal trade and for the meat has reduced the original population considerably and, if allowed to continue at the present rate, could jeopardize the survival of the species in the area within the next five years.

Extinction at Alto Arbro would bring the species as a whole closer to the brink and would diminish the recreational value of the reserve because tourists come mainly to catch a glimpse of this rare mammal.

Local people are at present allowed by an informal agreement to collect brushwood and other forest goods in sections of the refuge open to commercial, selective logging, not far from prime bat-eater habitat.

Uncontrolled intrusions by the locals are a prime concern and it is recommended that current practise be discontinued and that entry into the refuge without permit be strictly prohibited and prosecuted.

Did Morgan do any global thinking?

How does one think globally ?

Put local events into regional, national, international context.

Global thinking traces the consequences of local action or the causes of local events to places outside the protected area, outside the region, to another country or continent. Judging by the above summary, Morgan did not do much global thinking.

Arrive at a balanced and accurate view of cause and effect.

Global thinking also looks at problems from different perspectives and in doing so yields a more balanced view. It is more accurate in placing responsibility where it belongs and identifies the disease rather than the symptoms.

With some more global thinking, Morgan could have written this:

The commercial logging operations in parts of the refuge, with their attendant use of heavy machinery and construction of logging roads, have a number of undesirable side-effects.

Most notably, logging infringes on the habitat of the primary forest species, including the endangered woolly bat-eater which has retreated from the disturbances to the most remote portions of the refuge. Logging roads have opened access to locals who find it now much easier to set traps in formerly remote parts of the refuge.

It is recommended that commercial logging be phased out for these reasons and that an education and participation program be established to solicit the assistance of the local people in protecting the woolly bat-eater in exchange for use rights in what is now the logging zone. In addition, appropriate legislation and an international trading ban would eliminate most of the incentive for trapping the bat-eater.

The few tourists who now stalk the bat-eater with camera and binoculars do not seem to upset the animals unduly. Any future expansion of visitor use, however, should be monitored for disruptive effects on the species.

How do the two versions differ?

non-global thinking

In the first version Morgan has a very narrow understanding of the problem. He treats the depletion of the bat-eater as the main problem although it is only one consequence of habitat degradation.

Has a narrow view of problem.

He is calling for a law and order solution without regard for the legitimate interests and traditional rights of the villagers and without trying a more conciliatory and cooperative approach first.

Offers single (law and order) solutions.

He seems to encourage an expansion of revenue generating tourism but does not caution about its possible consequences.

Emphasizes overt, monetary benefits.

global thinking

The second version recognizes habitat degradation as the main problem and identifies logging as the cause. It also refers to all affected species and not only to the bat-eater.

Identifies the real problems.

Recognizes influences which may originate far away.

Attributes problem to multiple causes.

The responsibility for the detrimental side-effects of logging are attributed to concession policy made by the administration and to logging companies whose trade links may reach across the ocean. He recommends use rights as an incentive to obtain cooperation from the local people. The second version also recognizes the role of the law maker and the influence of domestic or international trade in wild animals.

Global thinking leads to value judgements

Global thinking by the protected area educator draws attention to land use decisions which require disturbance or total conversion of TRFs. Interests clash over the question "Is the change justified or not?".

More rain forests will be converted to other uses whether we like it or not, but the gains of the conversion should at least outweigh the losses. The educator is rarely trained either to support or refute cost benefit analyses or to question the assumptions they explicitly or implicitly contain. In any case he will make value judgements.

If, for instance, a proposed reservoir would flood an apparently insignificant portion of the protected forest, the educator's judgement should probably be based on answers to questions like these.

- Has an independent party evaluated potential environmental impacts?
- Did the impact statement contain major objections, and, if yes, has the builder agreed to mitigate them?
- How long is the projected life-span of the project?

Global thinking draws attention to choices and trade-offs.

It could be that the proposed reservoir would flood a significant and central portion of the protected forest, seriously threatening its existence as a functioning ecosystem. Often a cost/benefit analysis would still come out in favour of the project because it neglects risks or considers some arguments as irrelevant which others find perfectly plausible. In this case the educator should probably question the societal value system which makes such analyses the accepted practice.

As a rule of thumb the educator should use sustainability and distribution of benefits as the basic criterion for value judgements. If the benefits accrue to local people, the conversion is more likely to be desirable and in the interest of those in need. Conversion for an unsustainable land use could still be justified but not without questioning the purpose and the distribution of benefits.

Many questions remain open and could become interesting subjects for discussion and debate, for instance:

- How should we define a functioning ecosystem?
- How do benefits have to be distributed in order to justify a conversion of TRF?

These questions are difficult to answer even when discussing a concrete situation and the outcome of the discussion will often be decided on the basis of personal values.

Are large scale development projects guilty of unsustainable resource use ?

The question is like asking "Do birds fly?". Yes, most of them do, but some swim and dive, and others run. Instead of making sweeping generalizations about development projects it is better to examine each separately and judge it by its individual merit.

the Jari project

Back in 1967 the American entrepreneur Daniel Ludwig had the vision of turning some 8,000 sq.km. of TRF in Brazil into a vast pulpwood plantation. He ordered a huge floating pulpmill and a power plant built in Japan and had them towed across the ocean and up the Jari river, a tributary of the Amazon.

The mill began to operate in 1979, consuming the fast growing gmelina trees planted previously to supply the mill on a sustained-yield basis. By the year 1980 one billion dollars had been invested but the plant still operated at a 80 million dollar loss in that year partly because of unanticipated environmental obstacles. The fast growing gmelina, for instance, did not grow as well as expected on the poor soil and yielded only half of what was anticipated.

In 1981 the plant supported directly and indirectly some 40,000 people but did not turn a profit. The project was taken over from the disillusioned Ludwig by a Brazilian consortium.

two ways to look at Jari

In the eyes of some, Jari is technically viable and therefore a success despite its troubles. After all, management did strive to adjust to environmental limitations, promised to maintain half of the land under virgin forest cover, and continues to support some 40,000 people.

They believe that given time and continued research, and with additional experience and expansion to gain greater economies of scale, plus unimpeded access to the world market, the project will become profitable.

Others would argue that problems are only beginning. In the future, plantations will have to be expanded just to make up for the proportion of native trees which now supplement those from the plantations. As nutrients are depleted, fertilizer must be applied at an additional cost and the risk of weeds, pests,and disease is bound to increase. The opponents would probably add that the one billion dollar investment spent elsewhere could have created many more jobs than the 3,350 Jari had in 1981, and could have satisfied more basic needs.

Which position do you support?
Which questions would you want answered before you make up your mind?

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local action

Thinking globally, it is easier to understand global relationships, but as individuals we are powerless to act globally. Instead we do whatever we can and in most cases this means we act locally and in the field of expertise where we can be most effective.

Here are some examples of local action on behalf of the rain forest:

- Planting a village forest is local action.
- Investigating corruption among forestry officials is local action.
- Implementing a TRF education program is local action.

A coalition of people from different walks of life but with similar interests can often influence local issues by organizing local action (see p.119). It is the combined effect of numerous local actions which brings about change. Try to find people who are also concerned with the survival of the rain forest and start local action.

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summary

In this section we raised the question of how and why to think globally.

- Global thinking improves our ability to reason in the interest of informed decision making.
- With global thinking we consider the tomorrow as well as the today.
- With global thinking it is easier to discover relationships between distant events.

- With global thinking we are more likely to discover the real causes of problems.
- Global thinking helps us recognize the values on which we make choices.

On the next page a tribesman, a farmer, a village headman, and a monk give their opinion on the causes and circumstances of rampant forest destruction in the district. Is global thinking evident from any of the statements? Who has the most balanced view and puts the problem into a larger context?

suggestions

How long is this rubber band ?

It depends on how far you stretch it, but you can only stretch it so far.

Resources which grow or are recycled can be used sustainably or not. Keeping the eggs is a sustainable use of the resource "chicken". Wringing its neck and eating it is, of course, a non-sustainable use.

Sustainability is not always as clear cut as this and to some extent the concept is flexible. The sustainable use of a forest for logging may mean unsustainable use in terms of species preservation. Sustainability can only be a general guideline, but what actually constitutes acceptable use is determined by the circumstances and by value judgements.

Water will always flow downhill but generating hydro power by the same reservoir has a time limit. All reservoirs eventually fill up with sediments and, strictly speaking, do not constitute a sustainable resource use.

But let us be pragmatic. If, for example, adequate protection of the watershed forest extends the useful life span of a reservoir to a hundred years or more, we probably should not oppose it on the grounds of non-sustainability alone.

If, on the other hand, the proposed reservoir would flood the last rain forest in the region while siltation would reduce the useful life-span to less than 50 years, a valuable forest would be sacrificed to a non-sustainable use.

farmer

My grandfather cleared this land when nobody wanted it. Aside from our regular rice land, we have always burned a few patches of forest for extra crops to sell in the market. Why should we start saving trees now to make the sawmill owner rich?

tribesman

Only twenty years ago I could walk towards the great river from dawn to dusk and meet no one. Now, only two hours from here, I see fire and smoke where last year's rain still fell on thick forest. I am afraid of the future. When the forest is all cut, where will my people go?

monk

We always used to have enough of everything, but nowadays people want more. The city people are telling us about progress and development. The villagers are trying to catch up to them, but are hopelessly behind in this race for possessions and status. The forest is cut down if it seems in the way but I wonder if any of them will ever make it to the finish line?

village headman

Since they finished the road through the hills, it is so much easier to transport our produce to the market and to take someone to the hospital. But the change has not been all for the better. I see smoke hanging over the hills and bare slopes on either side of the road. The deep pools where we used to catch the big fish are filling up with sand from the slopes and I hear that downstream wells begin to run dry after a couple of weeks without rain and irrigation ditches clog up after a heavy storm. We should call a meeting of all the headmen in the district to find a way of keeping the trees, at least on the steeper slopes.

solution

The arguments of the farmer and the tribesman are, understandably so, self-centered and show no signs of global thinking. The monk, on the other hand, sees deforestation as a phenomenon which accompanies development. In this way he identifies an underlying cause of deforestation and indirectly criticizes the choice people are making, but he offers no practical solution. The headman gives perhaps the most pragmatic view. He acknowledges the advantages of the new road but also recognizes its drawbacks. He realizes that his own interests are affected and those of others even more so, and he is prepared to act constructively in the common interest.

Values and Value Systems

What do we mean by "value"?

Anything you use or appreciate for whatever reason has value. What has value to you does not necessarily have the same value for someone else.

The values of the rain forest are the qualities and properties which it is valued for by some, by many, or by all.

Many different values make up the value system of a person or a society. Some values within that system are perceived more strongly than others (see p.79).

Self-interest has much to do with this perception but cultural influences (e.g. of ethics and religion) play a role too.

Education about the rain forest attempts to influence personal and societal value systems by promoting the values which are compatible with the continued existence of the rain forest.

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types of values

People value the TRF for different reasons. Being able to recognize and categorize values will later help you design a program.

intangible values

Intangible values cannot be quantified in material terms but should nevertheless be reckoned with when making decisions concerning the rain forest.

ethical values

Every single species of the rain forest has a right to exist and deep down we know that it would be wrong to cause or even allow any of them to become extinct.

aesthetic values

The mellow early morning glow of the peak of Machapuchare above Pokhara in Nepal has a value which cannot be bought or rented out.

cultural values

The rain forest provides the raw materials for village arts and crafts which are part of rural or tribal culture. The spiritual value of, for example, sacred trees can be included in this category.

recreational values

Waterfalls and wildlife in a scenic rain forest attract vacationers and tourists.

scientific/educational values

Many rain forest areas offer opportunities for research and nature study which increase our understanding of the ecosystem and how to best use it without losing it.

ecological values

Ecological values are inherent in the functioning and productivity of the TRF and other natural systems which depend on it. Economic values and intangible values are often by-products of ecological values. Downstream irrigation, for instance, is not independent of the upstream watershed forest.

The values of the rain forest in soil and watershed protection are normally taken for granted. As a rule these benefits from a standing forest do not vanish overnight but disappear gradually. Deteriorating trends are often not noticed until it is very difficult to stop them.

economic values

Some economic values are realized by extractive use of the resource. Tropical hardwoods have an economic value in domestic and export markets and TRFs have economic value when converted to other land uses. A great variety of forest goods have economic value in traditional economies.

Tourism, the commercialized form of recreation, is an example of a non-extractive use which has economic value because most ecological values and intangible values remain intact. Potential economic values are inherent in the ecological and intangible values. As long as rain forest species survive, science may discover values in them which are unknown now.

Ecological and intangible values usually suffer during extractive use. If the extractive use is sustainable, the other values may be impaired but efforts are made to respect and maintain them.

Some values are compatible but others are not.

A tree can be part of a watershed and provide shade for the farmer working the field next to it, but one and the same tree cannot bear fruit and yield timber at the same time.

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values and self-interest

Economic values are most easily identified with self-interest.

Most people would consider a fruit tree more valuable than a decorative shrub for the simple reason that you can eat the fruit but not the flowers. People attribute value according to what they feel is in their own best interest, and this often coincides with economic values and extractive uses.

Scientists of various disciplines voiced values at a symposium held at Yale University in 1980. The following three quotations suggest how opinions and values can vary among individuals with different professional backgrounds.

Values and Value Systems

Economist Robert E. Evenson:
"...if forest lands produce little or nothing to improve the real income and welfare of the masses of poor people in a tropical country, even their conversion to a severely eroded state does not represent a loss".

Anthropologist M.G. Smith:
"The greatest value of the fuelwood of tropical forests for the people of those countries (fossil fuel importing developing countries) is the evident valuelessness of this commodity on the world market."

Consultant Norman Myers:
"Not only will it (the demise of the tropical forests) mean the end of many of the greatest concentrations of species on earth, and of many of the most integrally diverse ecosystems on earth, it will mean a basic shift in earth's most dynamic evolutionary processes."

Which of the three passages is most difficult to identify with self-interest?

The perceptions of TRF values diverge widely.

- The economist's exclusive focus is on the monetary and material values obtained by extractive use.
- The anthropologist also stresses extractive values with strong self-interest connotations.
- The consultant's quote represents intangible values, ecological values, and potential economic values which are more difficult to relate to self-interest.

Whose values usually take precedence ?

Intangible, ecological, and potential economic values often lose out against the extractive economic values.

If the interests of two parties clash, the relative merits of values are usually less decisive in decision making than the influence and power held by their proponents. The cultural, spiritual, and economic values which native peoples attribute to the rain forest are invariably sacrificed to extractive use if tribal homelands contain mineral resources in demand by industry.

Which values should take precedence ?

Each situation is unique and there is no single answer to this question. As a rule of thumb however, TRFs should be converted to non-forest land use only if that use is sustainable and lasting benefits to the local people can be demonstrated. Values which support sustainable production for basic human needs deserve priority.

Sensible resource use or not ?

Tropical rain forest was cleared and burned in Papua New Guinea to make room for a hoop pine plantation. A manufacturer in Bulolo now turns the pines into throw-away chopsticks at the rate of 45 million pairs a month.

Throw-away chopsticks are not what most people would identify with basic human needs. And yet, it would be counterproductive for the educator to preach with passionate fervour against this waste of a valuable resource as long as production is sustainable, environmental impact is limited, and a reasonable share of the benefits accrues to those who need them most.

In general, avoid trying to coerce people verbally into agreeing with your point of view. Instead, coolly point out who benefits at whose expense and leave it to the listeners to defend their own interests.

You are in a dilemma if the conversion of TRF is for a morally unquestionable cause but not sustainable. In this case you can only point out that the intent is inconsistent with the eventual outcome.

summary

- Values can be grouped into intangible, ecological, and economic values.
- Some values are compatible and some are mutually exclusive.
- What people value depends on their world view and professional background.
- Political and economic power usually decides whose values take precedence.
- Values which support sustainable production, especially for local needs, should have priority.

suggestions

Let us practice attributing values to different interest groups.

The Khao Banthat wildlife sanctuary in southern Thailand covers 1267 sq km of TRF. The choice to place the area under protection was made in 1978.

attributing values to interest groups

Interests and values held by groups directly concerned with the area were, or should have been, considered before the decision was made. Some groups favour maintenance of the forest as it is. Others argue for partial or complete conversion to other land uses.

Briefly note which of the TRF values seem most important to each of the interest groups listed. Base your opinion on the statement supplied and on what you may know to be true for that group. If intangible values are involved specify which, e.g. "cultural".

Also, can you think of values which are shared by all?

In order to make the exercise more realistic, you may want to replace the names of the groups with those from your area of interest.

This group would like to continue collecting forest goods and clearing forests for shifting cultivation.

villagers living near boundary

For this group, the forest provides virtually everything.

forest tribe

This group uses the forest for nature study and outdoor activities.

teachers and students

This group would like to strictly protect the forest and its endangered species.

wildlife division personnel

This group would like to convert forest land to rubber plantations.

rubber growers

This group would like to maintain watershed protection to ensure irrigation water supply.

rice farmers

This group would like to see waterfalls and other scenic places near the towns preserved for weekend and holiday outings.

vacationers from town

solution

Once you begin to think about what motivates people you realize that they may belong to more than one target group. A rubber grower, for instance, can also be a vacationer from town.

On some level, all groups appreciate scenic beauty or feel that allowing a species to become extinct is morally wrong. Aesthetic and ethical values may not dominate, but they are probably present in all groups.

villagers living near boundary	Economic values (extractive values) dominate. Because the group lives in close proximity to the forest, cultural values are probably important too.
forest tribe	Spiritually and economically, this group is most dependent on the rain forest ecosystem. Ecological, economic, and intangible values seem equally important.
teachers and students	Educational values and to some extent recreational values.
wildlife division personnel	Professionally, this group is expected to safeguard ecological values and, indirectly, all those values which can be associated with them.
rubber growers	Their main interest is straightforward economic.
rice farmers	This group is interested mainly in the economic values of maintaining an intact watershed forest which also is an ecological value.
vacationers from town	Some cultural values (of visiting certain places on certain holidays) may be associated with the predominantly recreational values.

Part Two

Tropical Rain Forest and other Systems

Systems

pages 35-38 What a system is and how it works.

Natural and Social Systems

pages 39-42 Systems typical for a rain forest region.

Environmental Information Needs

pages 43-50 What an educator needs to know about the physical environment.

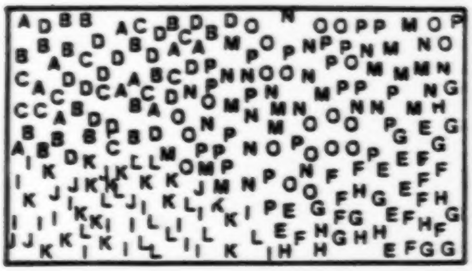
The Tropical Rain Forest Ecosystem

pages 51-70 How the system functions, its components and values.

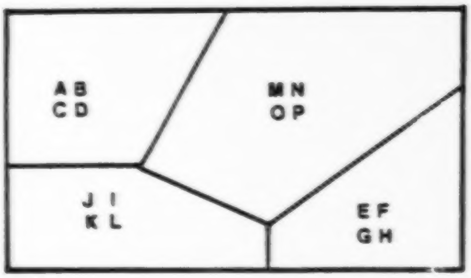
Human Production Systems (p.41)
Talking about the forest...
 Chief Xumu of the Huni Kuni Tribe (p.55)
Biogeographical Realms and Provinces (page 71)
Your heels hurt?
 Painful Side-Effects of Extractive Use (page 72)

Systems

What is the advantage of thinking in terms of systems?



Looking at a whole with many individual parts can be confusing. How, for example, can we make sense of this jumble of letters? For a start, we can determine which letters of the alphabet there are and where some letters are located in relation to the others.



If we discover similarities and patterns, we can subdivide the whole into more comprehensible groups. This also makes it easier to detect dependencies and to discover relationships. While the four groups of successive letters of the alphabet are now much less confusing to look at, they lack the most fundamental characteristic of any system: a meaningful relationship between its parts.

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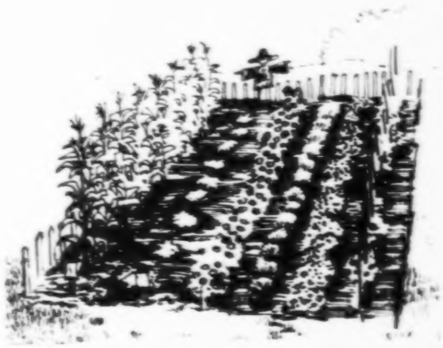
system characteristics

A kitchen garden is a system.

A kitchen garden is a system with living (biotic) and non-living (abiotic) components. The fence, the soil, and the plants are essential components of the system. The fence keeps the goats out. The soil provides support and nutrients for the plants. Without the flowers and vegetables it would not be a garden and cease to be a system.



If we grow a plant in a sealed glass container it is a closed system. The water which evaporates condenses on the glass and eventually seeps back into the soil. A dead leaf falls on the soil. There it decays and releases nutrients which are absorbed by the plant. The only essential input in this case is sunlight.

The physical transformation of liquid water into vapour and back into liquid is a cycle. The decomposition of a leaf, the release of its nutrients and subsequent reassembly into organic plant matter is also a cycle.

Plants grow by using the energy of sunlight to convert water, carbon dioxide, and nutrients into sugars and plant tissue. This conversion is crucial for the existence of the plant and it is therefore an essential process.

system outputs

All systems in the real world are open systems. A plant which is not grown in a sealed glass jar is an open system which needs other inputs besides sunlight: water, carbon dioxide, and mineral nutrients (fertilizer) for example.

Open systems have, of course, outputs. A dead leaf which drops to the floor has left the plant and has become an output. Outputs can be extractive or non-extractive. The beauty of a flower or its fragrant smell are non-extractive outputs. You can look at or smell the flower all day long without hurting it. Non-extractive outputs are therefore sustainable by definition.

Extractive outputs can be sustainable or not. Vegetables are there to eat and therefore an extractive output of the kitchen garden. Some vegetables and most fruit can be harvested without harming the plant which produced them. A well tended garden will produce a good crop year after year, but one that is neglected will not.

You will notice the terms "desirable outputs" and "undesirable outputs" in this and following sections.

desirable outputs: non-extractive outputs or extractive outputs which are valued by people and which do not jeopardize the system which generates them, or any other system.

undesirable outputs: waste products or extractive outputs which are valued by people but which cannot be sustained without harming the system from which they originate, or which are detrimental to other systems.

How are systems related ?

All open systems are related to other systems. They may themselves be part of a larger system or share some of its parts with other systems.

The garden receives its inputs, such as seeds, water, fertilizer, with the help of the gardener. The gardener is a system which influences another system, the garden.

Examining the relationships between systems it is always good to ask just what influence one has on the other and what the potential consequences of changes are. For example, is there someone who would take over from the gardener if he gets sick? The person replacing him might not do the job very well or forget it altogether.

systems in the real world

Systems in the real world are much more complex and the relationships are not always obvious. But with certain precautions the garden analogy can be applied to systems in the real world.

The kitchen garden system was simple because we chose to ignore many other factors such as soil quality, the skills of the gardener and his tools, etc. What we chose, the plants, the fence, and the soil, was enough however to illustrate the point. Real world systems are complex, and so we ignore some aspects and consider those we feel are most important.

Natural systems (e.g. forests, marshes) do not exist to produce extractive outputs but to maintain an environment in which all of their organisms can survive. They require little energy and other inputs to sustain life and they produce virtually no waste products which are dangerous or disruptive to other systems.

Traditional human production systems (e.g. subsistence agriculture or fisheries) generate specific outputs for human use or consumption. Production is mostly from local resources and for local use or consumption. Waste products, if there are any, are rarely dangerous or concentrated enough to upset the functions of other systems.

Modern human production systems (e.g. mechanized agriculture, factories) require high levels of energy and other inputs which may originate far away, for the production of outputs for local and non-local use or consumption. These systems often generate dangerous and persistent wastes.

system performance

A system is efficient if it maintains itself and produces desirable outputs sustainably at low levels of input and without generating potentially dangerous wastes. Natural production systems and traditional human production systems are efficient in this sense.

Modern human production systems are commonly regarded "efficient" in the sense that they are able to produce high levels of output at comparatively low financial cost. Cost is often artificially kept low by "sweeping waste products under the carpet" and by ignoring costs which are born by society.

Disturbances which trigger changes in system performance can often be traced to economic activities. The desirable output "cowdung" for example is a welcome resource in traditional human production systems, but becomes a waste disposal problem in highly centralized cattle raising operations when it leaks into water supplies.

Internal cycling keeps wanted (and unwanted) substances inside a system. Some systems, notably the tropical rain forest, are extremely efficient recyclers. Leaks which threaten the existence of a system are usually caused by people, and can therefore be avoided.

summary

- Systems have components, inputs, and outputs. They function by processes and cycles.
- Non-extractive system outputs are always sustainable. Extractive outputs may be sustainable or not.
- Systems are interrelated mainly because the output from one becomes input into another.
- A system is efficient if it maintains itself and produces outputs sustainably with low inputs, and without producing dangerous wastes.
- A deterioration of system performance is usually caused by people.

suggestions

List human production systems you are familiar with from your area and categorize them based on information given on page 37. Evaluate where they are on the continuum from traditional to modern production systems (see p.41). Note that production includes the "production" of services so that a barber shop or a hotel could be included in the list.

This is a good way to become familiar, in some detail, with the numerous ways in which people make a living in your area, and how they depend on, or impact on, the rain forest.

Natural and Social Systems

types of systems

As an educator you will be concerned with natural and social systems. Natural systems may exist without people. Social systems exist only because of people.

natural life-support systems

Natural life-support systems are nature's "factories" for the biological production of meat, fish, fibers, starches, oxygen without additional inputs by people.

The TRFs are natural life-support systems, and so are wetlands, freshwater lakes and rivers, mangrove swamps and estuaries, upwellings, etc. People often harvest outputs of these systems without expending any effort on the production of the goods. Fisheries is the best example for this.

human life-support systems

Human life-support systems are natural systems altered to produce more of certain outputs.

Most subsistence agriculture or traditional systems only slightly modify the natural system to serve their needs. Modern mechanized agriculture, on the other hand expends considerable inputs of labour and capital to radically alter natural systems. These include systems like self-sufficient traditional farming, subsistence and commercial fisheries, production forests, plantations and orchards, crop fields, range and grazing lands, fishponds, etc.

social systems

Social systems produce goods and services by processes other than biological production.

A city council is a social system designed to provide useful services for the community. Other social systems include factories, hospitals, sawmills, communication networks, irrigation systems, educational institutions, towns and villages, etc.
Social systems create desirable outputs, but they often produce undesirable outputs at the same time.

importance of social systems

For the educator, social systems are especially important because:

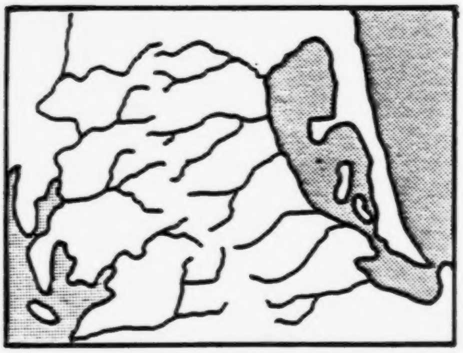
- They can have a significant impact on the TRF.
- They often produce goods and services highly valued by the educator's target group.
- They may become suitable outlets and supporters of the educator's message.

a region and its systems

Section of the Southern Thai Peninsula.

The illustrations on the left show a section of the southern Thai peninsula with two coastlines: the Andaman sea on the left, and the Gulf of Thailand on the right.

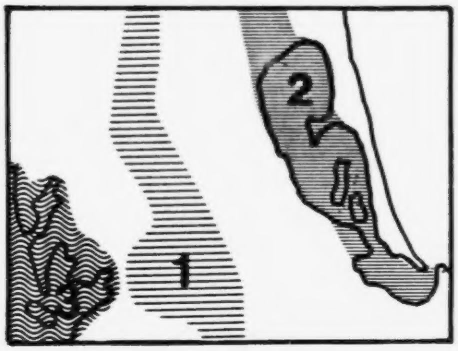
The region has many of the features and systems typical for the humid tropics and within its relatively small area (about 10,000 sq.km.) contains a number of natural and social systems.



Watershed and Drainage Basin.

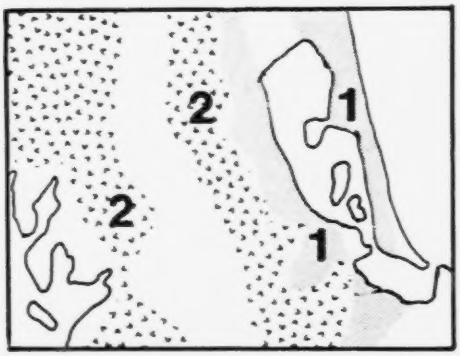
The primary area of concern coincides with the drainage basins of the streams which originate in the central hill range that is aligned approximately north to south.

For reasons to be explained later, the watersheds and drainage basins form the overall system we will be concerned with. All other land-based systems are contained within this larger system.



Natural Life-Support Systems

From the rainforest ecosystem (1) of the central Banthat hill range, streams flow east into the Thale Luang freshwater lake system (2) and its adjoining wetlands. Streams which flow west empty into vast mangrove lined estuaries (3).



Human Life-Support Systems

The major agricultural land uses are rice farming (1) mainly on the fertile alluvial plains in the vicinity of the lake, and rubber plantations (2) on the less fertile and drier soils further inland.

Natural and Social Systems

Social Systems

The Khao Banthat Wildlife Sanctuary (a) straddles the central hill range and occupies portions of four provinces. Paved roads provide easy access to parts of the sanctuary from provincial capitals (●) and other towns.

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watershed and drainage basin

The water quality and flow of rivers and streams are greatly influenced by the land use in the watershed.

Water is an essential ingredient for all life-support systems and many social systems. It flows in and out of systems, affects systems, and the quality and quantity of flow is affected by them.

Educators concerned with rain forest values are interested in the geographic area which encompasses:

- The watershed that is protected by the forest.
- The drainage basins of streams which originate in the forest or flow through it.

This physical area is likely to contain most relevant concerns.

watershed = the area drained by a river or a river system;
a ridge or stretch of highland dividing the areas drained by different rivers or river systems;

Human Production Systems

	traditional	intermediate	modern
examples	Fishing as a part time occupation for home consumption or local trade; fishing implements are home-made.	Professional fishing of marketable species for sale in local or regional market; Use of small boats and unsophisticated equipment; fishponds fertilized with household waste	Fishing for specific species for sale in a national or international market; use of large boats and sophisticated equipment.
characteristics	low input/low output little or no waste local resources used product is for local consumption/use technology is not advanced		high input/output non-local resources non-local use or consumption advanced technology

suggestions

Before you design an education program about the rain forest you will need to analyze systems. The matrix below provides you with a framework for analysis of the features the protected area educator is most interested in. The aim is to obtain a well rounded view of what seems most significant and therefore deserves to be presented in greater detail through an educational program (see p.69 for an example).

Other structures can, of course, be applied to systems analysis and social systems especially can be examined from a variety of perspectives. Cochrane (see citation on p.123), for instance, looks at regional social systems and relationships in order to identify the poorest. In particular he recommends to be aware of social groups, social organization, belief systems, wealth forms, patterns of mobility, and the nature of poverty.

Because the poorest are often most dependent on extractive or non-extractive outputs of protected areas, this approach is also relevant for the protected area educator, and Cochrane's book "The Cultural Appraisal of Development Projects" is highly recommended for that reason.

systems analysis matrix

- Description of the System
  Name of the system.
  Location and size of the system.
  Significant system components

- System Maintenance
  Internal cycles and processes.
  Essential inputs.
  Acute threats to system functions.

- Outputs and Links
  Desirable outputs
    Do outputs become essential inputs into other systems?
    Who benefits from them?
  Undesirable outputs
    Who/what is causing them?
    Who is affected by them?
  Relationship to Protected Area
    How does the system affect the protected area?
    Does the system depend in any way on the protected area? In which way?

Compile a list of major systems in your area and choose one to analyze. Usually it takes a while to become familiar enough with a subject, and you may therefore want to collect ideas relevant to each heading over a period of several weeks, then sort the wheat from the chaff and write the analysis.

factual information to be considered

In addition to material about the systems in the area of concern, the educator should gather information and data on factors determining the physical environment.

Soils, hydrology, climate, and topography largely determine the productivity of life-support systems.

- Water is an essential ingredient of virtually all production systems.
- Soil is the medium for terrestrial primary growth but it can produce only if there is sufficient water.
- The climate furnishes the conditions under which soil, water, and solar energy interact to produce organic matter.
- Topography has a considerable influence on soil/water interactions.

climate

Seasonal and spatial distribution as well as intensity of rainfall, not averages, are important.

Most soil erosion takes place during severe rainstorms. Where high intensity storms occur, the erosion hazard is great. A high erosion hazard constitutes a convincing argument for keeping land under forest.

Seasonal distribution of rainfall reveals the length of dry and wet periods and the spatial distribution shows "wet spots" and "dry spots". In an area where rainfall is high and concentrated in a few weeks or months, the soil erosion and flooding risk is high. A similar argument can be made for drought prone locations, and both constitute plausible arguments for maintaining a forested watershed.

topography

Slopes are more susceptible to erosion than flat land, especially where steep slopes coincide with high rainfall and poor soils. Flash floods triggered by the rapid runoff from steep deforested slopes can be destructive in the lowlands, providing a plausible argument for keeping steeplands under forest cover.

soil

The TRF is the climax vegetation of the humid tropics; that is, if left undisturbed it will perpetuate itself and only change by the process of evolution in response to long-term changes in the environment. The TRF, then, is by definition the kind of natural vegetation the soil is able to support.

soil erosion

As a rule of thumb, we should treat the soil in a way which allows it to return to this natural state. Soil erosion will slow or prevent the return to climax forest. The erosion hazard is determined by:

- The degree of exposure to erosive forces
  - timing, intensity, and amount of rainfall
  - topography (steepness, length, shape of slope)
  - vegetation cover and land use
- Intrinsic soil properties
  - capacity of the soil to absorb water
  - resistance to breaking up into small particles

soil capability

Classifying soils into capability classes often provides convincing arguments against deforestation.

Suitable soils are fit for permanent sustained production of agricultural crops without limitations. These soils are probably under cultivation already. If not, the educator will find it difficult to argue that they should remain under forest. The fact that most of the good soils are in the lowlands explains the scarcity of tropical lowland forests.

Moderately suitable soils are suitable for tree crops. They include soils which are erosion prone, soils with low natural fertility, or soils with drainage problems. With certain precautions or additional inputs they may become suitable for more demanding crops. These soils are only marginally suited for agriculture and, the question of whether conversion of the original rain forest cover can be justified must be decided on the merits of the individual case. With increasing scarcity of land, use restrictions will become controversial.

Unsuitable soils include the shallow and stony soils of the steeplands, acid, saline, or sterile sandy soils. Without exceptional effort they are unsuitable for any kind of sustainable extractive use and should therefore remain forested.

hydrology

water, a basic need

No need is more basic than clean water for drinking and daily use. Water is essential for cooking and other household use. It can be a source of energy, an ingredient of industrial processes, an attraction for recreation. To have enough of it at a good enough quality is a prerequisite for all life-sustaining processes and virtually all economic activity.

Especially where people cannot afford to pipe water from far away, the condition of streams, rivers, ponds, lakes, and underground becomes a matter of survival. The region described on pages 40/41 is typical for most TRF regions. Approximately 90% of the population obtain their water from open wells or natural bodies of water. Around 75% of the people who have work are employed in agriculture, forestry, or fisheries.

Simply stated, people need enough water, but not too much of it, at all times and in the right place.

groundwater

How much water the soil holds in the root zone of the plants is in part determined by the height of the ground water level. If it sinks too low, crop failure may be the result, and wells in the villages may run dry. If the ground water level falls in the coastal regions, the boundary between fresh and salt water recedes inland and the intrusion of salt water may ruin agricultural land.

streamflow

Excessive flow fluctuations cause flooding and drought, which harm fisheries and crops and damage physical property. The great productivity of estuaries, for instance, depends on internal nutrient recycling and a delicate balance of salinity. A freshwater rush or a drying up of freshwater inflow causes a shift in salinity and may interrupt the recycling process.

A minimum streamflow is necessary to feed irrigation systems. If a feeder stream to an irrigation system dries up during a critical time, a dry season crop may wither. Destructive streamflow erodes stream beds and banks and deposits silt and debris in irrigation canals and impoundments.

runoff

The rainfall on an area leaves it again through the air and through the ground. What is not evaporated or held in the soil percolates down into the groundwater or runs off at the surface. Both subsurface and surface runoff reappear in the streams which drain the area. Everything which delays the runoff and spreads it out over a longer period of time regulates streamflow.

evapotranspiration

Next to rainfall, evapotranspiration is the major variable. Evapotranspiration refers to the amount of water evaporated back into the air from soil and plant surfaces. The TRF with its large leaf surface area has a rate of evapotranspiration amounting to more than 50% of the precipitation.

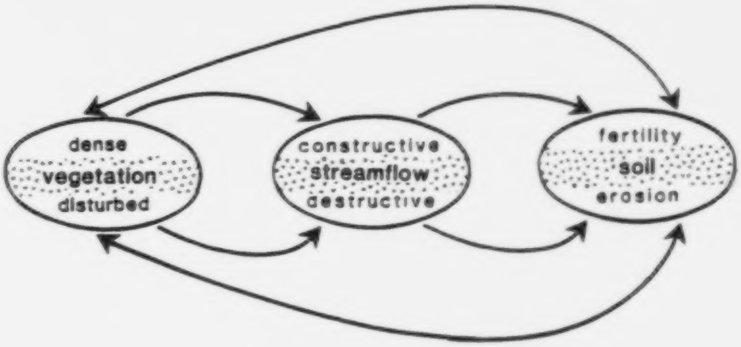
Because of this relationship (and assuming equal rainfall), deforestation can explain unusual streamflow fluctuations and increased runoff.

watershed vegetation cover

	Deforested Watershed	Forested Watershed
evapo-transpiration	low	high
total runoff	high	low
distribution of runoff	most runoff during or right after the rain	most runoff between rains
erosion hazard	high turbid water	low clear water
nature of the stream flow	erratic with high peak flow and very low minimum flow;	lower dry season flow, but difference between min. and maximum flow less pronounced;

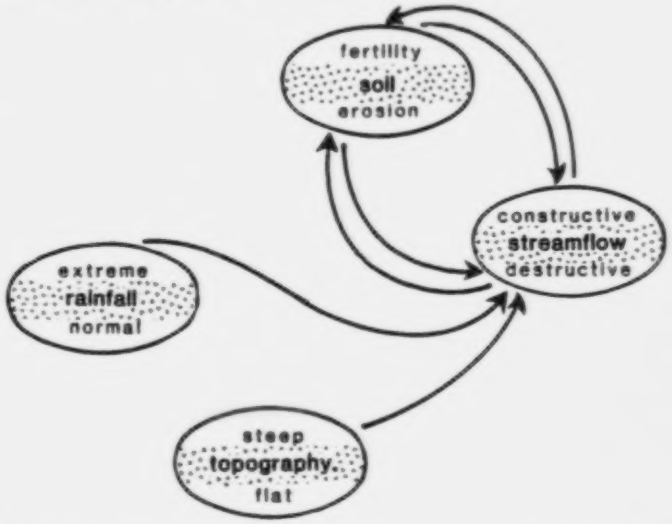
The influence of watershed vegetation cover.

The relationship between streamflow, vegetation, and soil is graphically summarized below.



The dense plant cover of a forested watershed keeps fertile top soil in place and results in constructive streamflow. Streamflow is constructive if it carries enough water for downstream uses, but not too much to cause damage.

The disturbed plant cover of a deforested watershed results in destructive streamflow accompanied by soil erosion. Because of the erosion, forest has difficulty reestablishing itself.



Relationships between the four major factors in the physical environment.

summary

- The pool of factual information for environmental education programs should contain material about climate, topography, soil, and hydrology.
- Of the climatic data, distribution and extremes of rainfall are the most significant.
- The steeper the slope the greater the erosion hazard.
- For an evaluation of streamflow fluctuations, evapotranspiration is the major variable influenced by human land use.
- Streamflow and groundwater are central to human interest because of their effect on crop and fishery yields, and the availability of drinking water.
- Rainfall and topography act independently on soil, runoff, and streamflow. Streamflow, soil erosion, and vegetation are not independent from each other.

suggestions

land use exercise

Imagine yourself as the wildland office's advisor to the National Planning Board which considers opening a largely forested region to plantation tree crops and irrigated rice farming. For simplicity, the area is represented as a rectangle subdivided into squares 1a, 1b, etc. Use the grid below for jotting down information given on page 49.

Evaluate land capability square by square according to the information given below and make a value judgement where in doubt.

You can choose between three types of land uses:

- Maintaining the original primary forest. **F**
- Converting the forest to tree crops. **T**
- Clearing the forest for field crops. **C**

1				
2				
3				
	a	b	c	d

Environmental Information Needs

	land use exercise information
1. Assume that all of the area except 1d is forested. The forest on 2d is degraded.	forest cover
2. All of row "a" is flatland with mangrove swamps and estuaries along the coastal fringe. All of row "b" is steeplands. All of row "c" is undulating, with some limestone outcrops. All of row "d" is flat, alluvial plains.	topography
3. Row "b" has the highest rainfall of the region and much of it falls during the two month peak of the northeast monsoon. In exceptionally dry years the "d" row may go without rain for up to 10 weeks.	rainfall
4. Soils on 2a and on all "b" squares are unsuitable for agriculture. Square 1a and all "c" squares are moderately suitable. All "d" squares and 3a are fertile agricultural land suitable for the most demanding field crops. Square 1d is already under intensive, irrigated rice paddy and the planning board intends to extend irrigation to 2d and 3d in the near future.	soil
5. All streams in the area flow due east or west from the steeplands of the "b" squares. The ground water table in the "c" squares is generally low because of excessive drainage of the porous soils.	hydrology
6. 1d is densely populated. All "a" squares have a rich estuarine fishery whose yield is sensitive to salinity fluctuations caused by freshwater inflow. Reliable reports confirmed the presence of the endangered Sumatran rhinoceros in 3a. The last lowland forest of the wider region is on squares 3a and 3d. Throughout the region, people obtain firewood and numerous other resources from the forest. Tree crops are more like the original forest cover and are a better agricultural use of marginal soil than annual crops. The availability of drinking water and places for outdoor recreation is always a concern in the vicinity of population centers.	miscellaneous

Enter solutions (F, T, or C) in the grid.

	a	b	c	d
1				
2				
3				

solution

These are not objectively correct answers. Different arguments, interpretations, or judgements would yield different results.

Your recommendations may differ from those given for any of the following reasons:

a) You interpret the given information differently.
b) You have other priorities and place more/less weight on some of the arguments.
c) You forgot to consider something.

	a	b	c	d
1	F	F	F	C
2	F	F	T	C
3	F	F	T	C

1a Moderate soil suitability would allow conversion to tree crop, but other areas farther away from coastal wetlands should be developed first. This would also alleviate any possible damage to the coastal fisheries. For now keep under forest, consider conversion later.

2a Because of proximity to coastal wetlands and unsuitable soils, keep under forest.

3a The fertile soil would allow conversion to field crop, but several arguments speak against it. Clearing of the forest alters the local hydrology and may result in salt intrusions from the nearby coastal wetlands. Protecting the endangered rhinoceros as well as the lowland forest ecosystem demand that no development take place here. A value judgement on ethical grounds would decide in favour of keeping the original forest.

1b/2b/3b High intensity and amount of rainfall, poor soils, and steep slopes suggest the area be best kept under original forest cover. Maintaining the forest is also in the interest of coastal fisheries as well as irrigation and drinking water supply. The latter is particularly important for the "d" squares which are susceptible to drought.

1c The moderately suitable soils would allow conversion to tree crops but the proximity to densely populated area 1d probably requires that the forest be maintained for drinking water catchment and recreation as well as for the already built irrigation system.

2c/3c The soils with excessive drainage problems suggest that if conversion takes place it best be to tree crops.

1d This area is well suited for and already under field crops.

2d There is no obvious reason why the already degraded forest should not be cleared to make the fertile soil available to field crop agriculture.

3d As an example of the endangered ecosystem "lowland rain forest," the conservationist would like to preserve it in its original state. The pragmatic educator could recommend delays but should probably not argue against its conversion to field crops.

The Tropical Rain Forest Ecosystem

Let us look at one system in more detail, the tropical rain forest. The TRF is a natural life-support system with components, internal processes and cycles, inputs and outputs. In the following sections you will find a highly condensed description containing the fundamental facts and principles about the rain forest system which ought to be considered for an educational program.

Of the system components, we will discuss soil and plants/animals. The nutrient cycle is representative of internal cycles and processes and will be discussed in conjunction with soil.

Water flows freely in and out of the system and, because it is always present, one can regard it also as a system component on which all else depends. Water has to some extent been treated within the previous section and will be referred to again in the section on values.

We will present some information on genetic resources, take up once more the question of values as apparent from several real world examples, and end with an analysis of a TRF ecosystem.

plants

biomass = (dry) weight of living organic matter

Plants and animals make up the living components of the ecosystem. Almost all of its biomass is contained in the plants, mostly in the trees. A biomass of 298 tons per hectare was measured for Amazonian forest with animal biomass amounting to less than one tenth of a percent.

Trees are obviously the dominant group of plants, with up to 750 different species in an area of 10 sq km. The greatest number of species is usually found in lowland forests.

Different tree species grow to different heights and their crowns form three more or less distinct layers called canopies.

canopy = layer of tree tops

upper canopy: topmost layer (but below the scattered giants), 40-50 m high, 30-40 trees/ha.
middle canopy: below the upper canopy, about 30m high 80-160 trees/ha.
lower canopy: 5-20 m high (palms, bamboo, saplings), 400-500 trees/ha.

Many trees have buttress roots which may begin to flare out from the trunk several meters above ground. The buttresses give the tree a firmer base to stand on, since the root system is not deeply anchored in the soil. The roots hug the ground, spreading out far but not deep because most of the plant nutrients are contained in the thin top soil.

epiphytes = plants which are not rooted in soil (e.g. many orchids)

Perched on trunks and branches of the trees are epiphytes. Between the trees, climbers are strung out providing arboreal pathways for creatures which in a lifetime may never touch the ground. Shrubs, bamboos, palms, saplings, and seedlings make up the lowest layer, which is really dense only where for some reason the upper canopies are disturbed and light is able to reach the forest floor.

advantage of having canopies

Plants have successfully competed for a place in "their" canopy by a variety of strategies, such as shade tolerance for those of the lower canopy. The spatial arrangement of the vegetation in layers has major advantages for the system as a whole. It protects the forest floor soil from the onslaught of rain storms and the dessicating heat of the sun, thus preventing soil erosion and maintaining the ability of the soil to absorb water.

The vegetation layer also slows air movement in and out and helps maintain a favourable internal micro-climate where diurnal (day/night) temperature fluctuations are minimal and humidity is high.

animals

Animals, taking advantage of the food and shelter offered by the plants, are more important than their small proportion (0.1%) of the total TRF biomass would suggest. Some of them pollinate the plants or disperse their seeds. Predators control the abundance of prey species. Others dig holes in the ground, mixing the soil and aerating and opening it to water infiltration.

species richness = number of species represented in an area without regard to the number of individuals each species is represented by.

In a 2,000 sq.km. area of the Makokou rain forest in Gabon, scientists recorded 119 species of mammals, 342 species of birds, 63 species of reptiles, and 38 species of amphibians. In Kartabo, Guyana, 464 bird species were identified in an area of only 0.6 sq.km. Close to half of the mammal species are arboreal.

The myriads of insect species and the minute microbes and bacteria are more difficult to identify and catalogue. As an indication, in one study 50 species of ants were counted in only one square meter of forest floor, and 550 species of butterflies have been collected from the Ega area of the Amazon.

niche = subdivision of habitat and environmental conditions

The vertical extension of the arboreal habitat is in part responsible for the species richness of the TRF, because it created numerous niches which enabled the evolution of climbing and flying creatures.

The TRF has evolved undisturbed for over thirty million years in some places, time enough for a great many creatures to adapt to a relatively constant environment. This long period of time allowed many species to exploit their rain forest habitat more efficiently, gain an advantage over other species, and to utilize new niches. Thus lizards have become adapted to gliding from tree to tree and birds to sucking nectar like the bees.

How many rain forest species are there ?

In the TRF there are today many more species than in any other land ecosystem in the world. Estimates have placed the total number of TRF species at 4-5 million adding that the majority still await discovery and description. But how could one ever hazard a guess at their number?

Much effort is spent on converting TRFs into human production systems, but little on finding out what species are lost in the process. Wherever the effort is made, species new to science are virtually certain to be discovered.

Of 125 tree species (not including lower plants) on a lot the size of two soccer fields in the Amazon forest, twenty species were unknown to science. One could repeat similar surveys many times over in other places with similar results. Considering that many thousands of such patches are still there to explore, the above species estimate does not seem far fetched.

endemic = restricted to a particular area or location

Many of the rain forest species are endemic. That is, they occur only locally, and their overall distribution is restricted, with a consequently higher risk of extinction.

specialization and interdependence

Many species are highly specialized, which may mean that they depend on certain events to happen at the right time, like a tree to flower or fruit, another animal to hatch, and so on. The specialization could also mean that the organism can only function within a very narrow range of environmental conditions and could not survive great fluctuations of, for example, humidity. It is this high degree of specialization which makes the rain forest species so vulnerable to disturbances of the ecosystem in which they live.

Specialization may also mean dependence on other species. While this is not unique to the TRF, nowhere else has species interdependence become as important as in the TRF.

A single pollinator may be responsible for the pollination of several fruiting tree species whose fruiting times are spaced out over the entire year with little overlap. Because many tree species may only be represented by single trees within the range of the pollinator, the fragmentation and disturbance of the forest could remove a flowering tree of critical importance and cause the pollinator to disappear from the area.

extinction

gene pool = the total of all genetic variation within a species

We do not know what exactly is going to happen to which species if such links are removed from the food web, but enough studies have been done to prove that these relationships and dependencies are the rule rather than the exception, and that extinction is often close.

If it is not yet the whole species which disappears along with a forest, forest clearing is always accompanied by an impoverishment of the gene pool of the affected species and a lowering of their evolutionary and survival potential.

There is no question that forest conversion will continue, but in order to see clearly the value judgements and choices involved, decision makers ought to consider the scarcity or vulnerability of species and the sheer ignorance of what is there in the first place.

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summary

- The spatial arrangement of the TRF in crown layers (canopies) protects the soil and offers more niche space than other terrestrial habitats.
- TRFs are more species rich than other ecosystems, but the majority of these species has yet to be discovered and described.
- TRF species tend to be highly specialized, interdependent, and therefore vulnerable to disturbances of the habitat.

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suggestions

In preparation for designing your educational program, try to locate and obtain copies of studies on the ecology, fauna and flora of your area or very similar areas near by.

See if you can find evidence of ...

- new species discovered recently.
- species having become extinct or becoming rare.
- striking examples of specialization and interdependence.

Talking about the forest...

O most powerful spirit
of the bush with the fragrant leaves
we are here again to seek wisdom
give us tranquility and guidance
to understand the mysteries of the forest
the knowledge of our ancestors

Chief Xumu of the Huni Kuni Tribe in the Amazon (quoted by F. Bruce Lamb in Wizard of the Amazon).

Our attitude towards the forest is revealed by the words we use to describe it. If we talk about it only in abstract and technical terms, then timber growth rates and similar resource values are all that count.

Let us never forget what the forest means to its people, and what it could, perhaps, also mean to us.

True or false ?

Upon exposure to sun and air, rain forest soils invariably harden into a rocklike substance by a process called laterization.

Soils which support the lush growth of a tropical rain forest will also grow rich harvests of tropical food crops.

Both statements are false because they reflect exceptions rather than the rule. Let us look therefore at some of the true characteristics of TRF soils.

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nutrients

If they have enough light, plants grow fast in the constant warmth and humidity of TRF, but only as long as they do not run out of nutrients. Plant nutrients are freed from the bedrock by weathering or become available as dead organic matter decomposes. The nutrient supply resulting from weathering is very low in the, for the most part, already deeply weathered and leached soils of the humid tropics and dead organic matter is the only significant source of nutrients.

decomposition

The detritivores and decomposers are continuously at work breaking down dead organic matter and releasing a steady stream of nutrients into the topsoil. From there they would be quickly washed out were it not for the dense rootmat of the living plants eager to absorb them. This cycle of growth-decay-growth is called the nutrient cycle.

An important link in the cycle is fungal hyphae which spread out over the forest floor and are attached to tree roots. The fungus grows over and into decomposing litter and the freed nutrients are passed directly and without loss from fungus to tree root. Unfortunately, this delicate network is easily destroyed by burning.

nutrient depletion

After clearing and burning, the nutrient content of the topsoil, enriched by the ashes, goes up temporarily. But beginning with the first rain and regrowth of vegetation the nutrient content of the soil declines. The general process of deterioration is halted as soon as dense ground cover is reestablished, and reversed as biomass once more accumulates in the standing forest (see pages 57/58).

If plant nutrients are depleted too much as in repeated, short fallow clearing; if the soil hardens and compacts; if the soil fauna disappears, then recovery may no longer be possible, and man has created a barren, useless parcel of land.

soil/forest relationship

It is one of the characteristics of a fertile soil that nutrients removed with a crop or by clearing can be replaced by the soil itself. Generally speaking, the soils of the TRF are not a storehouse of plant nutrients, as these are mostly contained in the biomass.

As long as the climax forest remains undisturbed, plant growth is rather independent of the inherent fertility and the physical properties of the soil because of quick nutrient recycling.

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soil deterioration

The quality and characteristics of the soil become crucial, however, as soon as the forest is cleared and the ground is exposed to the sun and the full impact of rainfall. (see p.43/44)

Poor, erosion-prone soils in exposed locations can deteriorate, within a few years or perhaps one wet season in extreme cases, to a state where they can no longer support plant growth.

Some soils will harden into a rocklike substance upon exposure to air in a process called laterization. Laterization occurs mostly in seasonal tropical climates and is, therefore, most widespread in Africa.

However, the problem of laterization is often exaggerated as potentially afflicting most of the tropical soils. In the Amazon, for instance, only 4% of the soils are susceptible to laterization.

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extractive use

Tropical soils will recover after clearing if plant cover is established quickly and any extractive use is not too intensive and prolonged.

How long the TRF soil can be used for extractive purposes is determined by its physical and chemical properties. How long it takes to recover depends on the state it has been in when left to fallow and how quickly the forest is able to reestablish itself.

Fertile soils on level land can be used for extractive purposes for many years without fallow, but shallow stony soils on steep slopes will barely survive a single season of cropping.

shifting cultivation

shifting cultivation =
slash and burn agriculture
or swidden agriculture

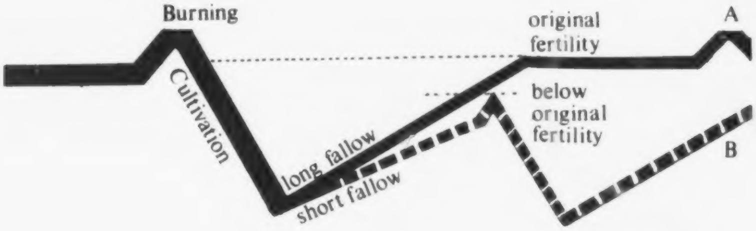
Shifting cultivators clear and burn the forest to temporarily increase the natural fertility of the soil. With the exposure to the elements and with the removal of crops, the physical properties of the soil deteriorate and nutrient content declines. A gradual recovery is possible to where it will again support forest, provided it does not deteriorate to the point when only the most hardy grasses and weeds will grow.

nutrient restoration during fallow

Shifting cultivation is an efficient and sustainable land use if the cultivator observes the minimum fallow time required to replace the nutrients lost during clearing, burning, cultivation, and harvest.

The actual time needed for a complete recovery depends on local conditions, the type and intensity of use, and soil quality. Studies have shown that in many places an 8-10 year fallow replaces 70%-90% of the nutrients contained in the biomass. Thirty years is normally considered a safe time for fallow and fifteen is near the lower limit.

Shorter fallows progressively diminish soil fertility to the eventual ruin of the resource as shown graphically below.



(**A**) Soil nutrient content quickly rises after burning, declines with cultivation, and recovers to previous levels during a long fallow.

(**B**) Previous nutrient levels are not regained because of the short fallow.

If the locals do not observe the minimum fallow period, should you, the educator, tell them to do so, and why?

The locals are likely to know very well when and where to clear the forest for best results and the consequences of short term fallows. If they still risk a long term productivity decline of the land, which after all constitutes their livelihood, there must be other reasons. Maybe a lack of choice. In any case, try to find the reasons.

prevalent characteristics of TRF soils

Acid infertile soils are by far the most common and a good proportion of the remaining soils are poorly drained or prone to erosion. Old tropical soils are deeply weathered and, because of the high rainfall, leached of plant nutrients.

Some of the young alluvial soils and basic volcanic soils, however, are fertile and stable. The best of these, as a rule, are already under cultivation. While Asia has the greatest percentage of fertile soils it also has a high proportion of problem soils.

soil types	World	Africa	Asia	America
Acid, infertile soils unsuitable for agriculture or at best marginally suitable.	63%	56%	38%	82%
Moderately fertile well-drained soils. Mostly well suited for agriculture.	15%	12%	33%	7%
Infertile, shallow, sandy, or peat soils. Not suitable for agriculture.	20%	32%	28%	11%

Proportions of soil types in the humid tropics.
source: adapted from Ecological Aspects of Development in the Humid Tropics.

summary

- After a disruption of the nutrient cycle, deterioration of soil fertility is fast, but recovery is slow.
- The further the deterioration is allowed to proceed the slower the recovery and the less likely that it will be complete.
- High fertility of TRF soils is the exception rather than the rule.
- Agricultural use of moderately suitable TRF soil is possible, but limited by a fertility decline resulting from that use.
- Prolonged extractive use of poor TRF soils can lead to their complete ruin.

suggestions

Find out about the soils in your region.

- What suitability class are they in?
- Is swidden agriculture practised extensively? Where?
- Are fallows long enough to allow complete recovery?
- Are there examples of ruined soils?

genetic resource values

Genetic resource values are increasingly invoked by those who call for the preservation of representative ecosystems. All types of values overlap in the issue of genetic resource preservation because, in discussing the subject, one can neither escape the finality of extinction nor fail to consider the future, even if arguing only in terms of conventional economic value.

economic rationale

The economic rationale of genetic resource conservation is as follows.

The ancestors of numerous domesticated plants and animals are TRF species. Natives of all TRF regions are familiar with the medicinal properties of forest plants, some of which are also used for the commercial manufacture of drugs. Yet other TRF plants provided the "chemical blueprint" for the synthesis of substances in the laboratory, or supply industrial raw materials.

We need the genes contained in populations of the wild relatives of domesticated plants and animals to improve yields, increase resistance to disease, or adapt our domesticated species to different environments. It is also quite possible, if not likely, that we may discover yet more useful species, or learn how to use some of those already discovered.

Plant geneticists and animal breeders are constantly on the lookout for the desired traits. Unable to create genetic variations, they have to discover them in the "gene pool." The larger the pool, the greater the possibility of finding something promising, but with every decimation and every extinction of a population, the gene pool inevitably shrinks.

ethical /cultural rationale

The beautiful Kalij pheasant is Nepal's national bird, and the bird of paradise figures prominently on the national flag of Papua New Guinea. Cultural and aesthetic considerations attribute value to single species for their beauty, uniqueness, or role in history and religious tradition.

The ethical argument for genetic resource conservation focuses on the irreversibility and immorality of man-induced extinction of any species. Unfortunately, public opinion and ethical or moral barriers to species extinction are not very strong when obscure, less appealing species or inconspicuous plants are concerned.

species conservation

in situ/ex situ

Genetic resources can be conserved ex-situ or in-situ. In-situ conservation protects the habitat and, as a consequence, all the species in it. Ex-situ conservation maintains species outside their natural habitat.

Some of the large mammals might survive by maintaining viable breeding populations in zoological gardens, and seeds of selected plant species can be stored in "seed banks". For the vast majority of TRF species, only in-situ conservation can prevent extinction.

viable populations

The fate of a species may be sealed long before the last pair has vanished from the face of the earth. Small and fragmented populations command a much lower variability and become increasingly vulnerable to disease, inbreeding, and chance events. The exact size of a minimum contiguous and viable population is thought to be no lower than fifty individuals. The number varies with the species and the long-term stability of the habitat, but cannot be determined exactly except by extinction.

In order to remain in balance with their prey, large predators require upwards of ten square kilometers of territory for each individual. Protected areas have to be large to accommodate viable populations. Small reserves need to be connected by dispersal corridors to avoid splitting one viable population into several small populations which, isolated from each other, are doomed to extinction.

suggestions

- Begin to compile a list of plants and animals in your area and their economic use (e.g. fruits not commonly sold in markets, but collected by locals).
- Encourage or help local people to write down what they know of locally used medicinal plants.
- Begin to compile information about the cultural or religious significance of plants and animals. (animals/plants used in ceremonies, mentioned in folklore etc.)

From preceding sections you are already familiar with some of the values of the TRF. Using real world examples we will examine how people use the forest and value its benefits.

You will find that values inherent in sustainable uses depend on the ecological values of the standing forest. In general, cutting down forests and destroying its ecological values has far reaching impact. It benefits some, but hurts the majority.

As a result of deforestation, people. especially in a subsistence economy, lose resources for which they have no substitute. Downstream, people are affected by deteriorating water quality, lower yields in fisheries and agriculture, flood damage, and reduced access to recreational sites.

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example one

streamflow after deforestation

Khlong Thakhae drains part of the Banthat mountain range in southern Thailand. The stream originates in tropical rain forest and flows east through rubber plantations, secondary growth, and paddy land into the shallow Thale Luang lake. On the way some of its water is diverted into an extensive rice irrigation system near the provincial capital of Phatthalung.

The mean annual runoff in Khlong Thakhae was not quite 99 million cu.m. between 1967 and 1970. Ten years later, between 1976 and 1980, the mean annual runoff had increased to 164 million cu.m., although rainfall was about the same in both periods.

Deforestation by logging and subsequent shifting cultivation in the watershed during the mid and late seventies explains at least some of the change. The moisture which used to evaporate from the large leaf area of the forest now becomes stream runoff. More water comes down from the hills now, but the flow is erratic and sediment laden,with a higher probability of flooding and drying up.

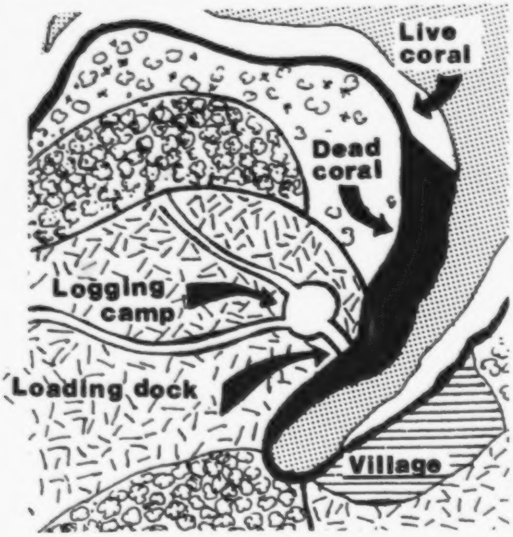
The possible consequences:

- Silting of the diversion dam at Tha Khae.
- Lowering of the water table out of reach of village wells.
- Sedimentation in the Thale Luang lake and a reduction in the yield of fisheries.
- Salinity intrusion into ricefields between the west coast and the lake shore.
- Flood damage to property, injury and death.

example two

siltation after logging

The quality and quantity of freshwater inflow affects coastal fisheries in estuaries and off coral reefs. Turbid water and salinity fluctuations caused by a freshwater rush alternating with very low flows can kill coral and disrupt system functions in estuaries.



Logging operations on the Indonesian island of Siberut resulted in excessive soil erosion which smothered nearby coral with sediment laden runoff. Normally it is difficult to tell just how much damage upstream deforestation does to fisheries, but in this case the cause/effect relationship is clear.

Fishermen from the village of Daerah Diperbesar fish the reefs from small boats. Part of the reef which is closest to their homes has become unproductive. Any benefit the village may have obtained from the is temporary. The loss from declining fishery yields is long-term, if not permanent.

The example is descriptive of how an economic use of forest resources can jeopardize the productivity of another resource. In the previous example the impacts were listed as potential because no documentation exists for what actually happened. In this example, that documentation exists.

Documentation of local events of this nature is an excellent tool for the protected area educator. If it does not exist, draw attention to the fact or try to gather the necessary evidence yourself.

example three

TRF conversion to pasture :

a traditional versus a modern production system

Peasants living near the confluence of the Tapajos and Amazon rivers in Brazil traditionally made a living by alternately cultivating crops in flood plain forest (varzea) and in upland forest (terra-firme). In addition they collected forest goods like the Brazil nut and rubber, amounting to over one third the value of the field crops.

Many raised cattle which they had to move back and forth between varzea and terra-firme in tune with the wet and dry seasons. Mortality of the cattle and the heavy labour of fodder collecting during the floods kept the herds down to generally fewer than 200 head. The land was open to all who were prepared to work it for a living, and few held official title.

The completion of a road link to the Trans Amazon Highway and economic/industrial development in the region led to profound changes during the seventies. The influx of migrants and tourists, for instance, triggered a sharp rise in beef prices.

Local entrepreneurs recognized the opportunity and converted terra-firme forests into pastures large enough for year round grazing of large herds without the need for much additional labour. Local ranchers are increasingly joined by foreign companies which also recognize the economic opportunity.

The Brazilian government supports the conversion of forest to pasture with credit programs and tax incentives even for the foreign investors.

Pasture land is under individual ownership and no longer open to or even suitable for the traditional swidden agriculture, and the Brazil nut and rubber trees of course disappeared with the forest. In the municipality of Alenquer, for example, the number of cattle increased from about 50,000 to some 89,000 head between 1974 and 1979, but the Brazil nut harvest plummeted from 8,000 tons to 1,650 tons.

Some of the peasants were able to make up for the loss by obtaining better prices for vegetable produce, but others found themselves deprived of their livelihood. In the province of Alenquer peasants asserted their right to access to the land in armed conflict with cattle ranchers.

multiple use versus grazing

The system of limited multiple use of varzea and terra-firme forest for agricultural crops, forest goods collection, and grazing has flourished for over 300 years, even yielding a surplus of primary products for export. It is now being exchanged for a pasture system which is far less sustainable.

The quality of the pastures deteriorates, but the profits from the initial venture allow the rancher to clear more forest. The new system is sustainable only as long as there is mature forest to expand into.

Clearing for pasture disrupts the ecological functions of the TRF, which the old system at least partly maintained and it deprives peasants of their livelihood without offering alternative employment.

Aside from the humanistic aspects, the new system does not even make strictly economic sense in areas where it has replaced dense stands of the valuable Brazil nut trees, which produced a highly valued product without any inputs except the labour to harvest them.

Multiple use is characteristic for the economic use of the forest resource by traditional societies living in close proximity to the forest. The system, however, does not produce the surplus required to buy modern consumer goods, and it can only support a limited number of people per unit area without deterioration of the resource.

Even the traditional system at Tapajos cannot be sustained indefinitely as long as the population keeps growing , but while the system still functions, it is foolish to exchange it for another which clearly cannot.

The interest of a relatively affluent minority in this case decides on how land is used, supported by the pervasive urban values contained in what is commonly called progress and development.

Governments often assume any kind of development to be in the public interest and they tend to overemphasize, just like the private entrepreneur, the economic values of the TRF which produces quick and measurable results with little consideration for the environmental cost which is born by others.

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example four

successful conversion of TRF to agriculture

Another example provides a different perspective.

A government resettlement project cleared some 40,000 hectares of suitable soils of rain forest in the Jengka triangle in the state of Pahang in peninsular Malaysia.

The project was expensive, costing about 15,000 US dollars per resettled family, but it was carefully planned, leaving the unsuitable soils under forest and planting the suitable cleared land with oil palm and rubber.

The 9000 families which settled in the area in the late sixties and early seventies have formed stable village communities and increased their income by about four times in ten years, without having to resort to further clearing and slash and burn agriculture of the surrounding forest.

As a result of the TRF conversion described above, some 35,000 people are now better off than they were before, without inflicting irreparable environmental damage. One may find fault with the project from a social point of view, e.g. it is too expensive for widespread replication, but it still seems a more sensible conversion of TRF than that in other examples.

example five

forest goods harvest:

traditional use and cultural values

The last example is from the Khao Chong area of the Khao Banthat Wildlife Sanctuary in Southern Thailand.

Widely scattered throughout the forest, single, huge trees attract swarms of the giant honeybee. The locals have given individual names to these trees which sometimes accommodate more than fifty colonies of bees in heavy combs suspended from the underside of the larger branches.

At Khao Chong "Hu Na Pha", the "Ear of the Steep Decline", is perched on the face of a steep precipice atop a roaring waterfall. At the height of the hot season, a few weeks before the bees migrate to another area, an old man of the Khao Chong village picks a crew of five or six younger men to begin the preparations preceding the arduous and hazardous collection of the honey combs. It is a great honour to be elected a member of this group.

During the week of preparations there are acknowledgements for the soul of the tree, for the spirit of the queen bee and those of other forest animals. Until the time when the honey harvest is over, the men enjoy a status equivalent in some respects to that of a monk.

The harvest takes place on a pitchblack, moonless night under ceaseless chants between the men precariously perched above on the main limbs of the giant tree and the others below busy squeezing the honey from the comb.

The spoils of the daring enterprise are divided into equal shares. Most of the wax and some of the honey is donated to the temple, while the rest is either sold or kept for personal consumption.

The knowledge and abilities of the local people are ideally suited for this endeavour which is enjoyable as well as profitable. It is a tradition which reinforces the social structure, respect for the aged and experienced, and it reminds the participants of spiritual and religious dimensions of the forest.

The loss of "Hu Na Pha" would not only mean the loss of fifty or so gallons of honey and the two or three dozen cakes of wax collected in each season, but it would also leave a void in the cultural heritage of the local people. The rites and ceremonies, the chants and skills would be forgotten, and there would be no more honey harvest to look forward to every year.

summary

- Large scale conversions of the TRF tend to favour the few over the many.
- Governments and commercial enterprises place a higher value on large scale and highly profitable conversions of the TRF than on more sustainable, but less profitable, uses.
- The interest of local populations and indigenous societies is usually better served by low key development which maintains the subsistence resource base, supports economic self-reliance, and avoids the disruption of functioning social structures.
- Large scale conversion of TRF is not detrimental by definition, especially if it is sound environmentally and planned with the basic needs of settlers in mind.
- The cultural values attached to traditional economic uses of the TRF resources may outweigh the value in material terms.

suggestions

Begin to collect information on how TRF resources are used in your area. Expand some examples into documented and detailed case studies. Such local studies are excellent material for education, and are relevant, real, and verifiable through first hand experience of friends and relatives of the learners.

Using the matrix on page 42, the analysis of a specific TRF ecosystem could look like this.

description of the system

Because of widespread clearing and conversion the Rain Forest of Southern Thailand now essentially coincides with the Banthat hill range which forms the backbone of the southern Thai peninsula all the way from Surathani south across the border and into Malaysia. Fauna and flora are representative for the Malayan Rain Forest Province of the Indomalayan Realm (see box p.71). No systematic studies or surveys have been undertaken, but a number of endangered species are known to occur. The soils are moderate to poor at elevations ranging from 200 to 1700 meters.

Three protected areas, Khao Poo, Khao Banthat, and Ton Nga Chang, form a crucial link to the south which, if severed, would isolate the bulk of the Thai rain forests from those in peninsular Malaysia. Of the three protected areas the 1,267 sq. km. Khao Banthat Wildlife Sanctuary is the largest and most central.

system maintenance

Deforestation in the region isolates and fragments plant and animal populations. The resulting genetic impoverishment jeopardizes species survival in the long run and impairs system functions in the short run. Trapping, meat hunting, and collecting of forest goods disturbs and depletes wildlife locally but is less problematic than habitat destruction by shifting cultivation, logging, and tin mining in some locations.

Clearing for upland crops especially disrupts the nutrient cycle and damages the fragile soils. In general, however, most cut over areas could still revert to forest if allowed to do so. In the vicinity of some tin mines and settlements soils have deteriorated to the point of supporting only herbs and grasses.

The conversion of forest to rubber plantations is pervasive. Because rubber plantations are better able than any other non-forest land use to protect watershed and soils, the conversion can, within limits, be justified on economic and ecological grounds.

outputs and links

The region economically depends on irrigated wet-rice agriculture and fisheries. The value of the forest lies therefore largely in watershed and soil protection. Population centers clustered around the major rice growing areas in Nakorn Srithammarat, Phatthalung, and Songkhla have a particular interest in preserving the watershed forest because low flows in the dry season could prevent double cropping of irrigated paddy and cause salinity intrusions in the narrow coastal strip between the Thale Luang lake and the Gulf of Thailand.

Fisheries in and around the estuaries of the east coast and in the very shallow Thale Luang and Thale Songkhla lakes are affected by the quality of the watershed forest.

People from the provincial capitals and other towns visit waterfall recreation areas in the forest, and villagers who live near the edge of the forest supplement their incomes and diets by collecting forest goods.

Protecting and managing the forest is a prerequisite for the continuation of the above benefits, but protection must be for specific purposes. Part of the region's timber and fuelwood demand is satisfied from the rain forest. Some areas are especially rich in wildlife resources while others are of outstanding value for recreation. Soil and watershed conservation is an important consideration all along the Banthat hill range.

Without protection it is likely that this rain forest will cease to exist as an intact and self-perpetuating system in the region. Apart from maintaining the system functions of the forest, the different designations of protected areas must also yield those goods and uses they are best suited for.

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suggestions

Try to write a similar analysis of a system of your choice using the matrix on page 42 as a guide.

Biogeographical Realms and Provinces

Since it is impossible to accord blanket protection to everything which ought to be protected, we have to give priority rankings to potential protected areas. One priority criterion is to have samples of all major plant and animal communities represented in a protected area system.

Classification schemes help the planner determine whether or not certain communities are adequately represented in protected areas or not. One widely accepted scheme classifies regions according to geographical and biological/ecological criteria.

The scheme subdivides the world into realms. Each realm is subdivided into provinces and within each province are biome types. Each biome type is given a number which does not change. Tropical moist forest is a biome type carrying the number one.

With three numbers you can identify any region in the world. The number for the Malayan Rain Forest in the preceding analysis is 4.7.1.

The first number stands for the "Indomalayan Realm".
The second number stands for the "Malayan Province".
The third number stands for the "TRF Biome Type".

Your heels hurt ?

So you bought your shoes too small and now you have a painful thumb-size blister on your heel. My grandmother had this remedy. Soak the heel of the shoe in water for several hours and then tap the offending part of the shoe with a small hammer on a hard surface hoping to soften the leather before beating a hole through it. Sometimes this actually works but, of course, the shoe will never be like the one which was comfortable from the day you bought it.

What has this to do with rain forest?

Because of the often painful side-effects, converting rain forest to production forests or clearing them for agricultural use is like trying to walk in shoes which are too small. The application of science sometimes allows extractive uses under certain conditions, but the bulk of the TRFs are unpromising sources of large scale extractive outputs.

The reputation of environmentalists as irrational enemies of progress stems partly from sweeping generalizations about the vulnerability of rain forest soils. It is better to avoid even the appearance of being steadfastly set against progress and instead, calmly point out where "the shoe is going to hurt and what one can do about it".

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Part Three

Education Concerns and Program Options

Introduction to Part Three

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Environmental Values Education

pages 76-82 The role of environmental education in changing value systems.

The Learning Domains

pages 83-89 Education should appeal to the rational mind, to feelings and teach the skills required for change.

Roles of the Educator

pages 90-93 Public relations, visitor management, environmental education, and public participation roles.

Problems and Objectives of Protected Areas

pages 94-98 Developing educational programs to solve problems of the protected area.

Target Groups

pages 99-102 Target groups cause and/or influence problems of the protected area.

Action Planning

pages 103-111 Developing an idea into an action plan, implementing the plan, and evaluating progress throughout implementation.

Program Options

pages 112-118 Well developed program options are the basis for effective educational programs.

Local Action Saves the Lowland Rain Forest of Taman Negara

pages 119-122 The fight for lowland rain forest of the Taman Negara National Park of Malaysia.

A problem and possible solutions (p.78)
Who will come to the rescue?
 The trust in technology may not be justified. (p.82)
Writing in the Affective Domain
 Excerpt from the memoirs of Pablo Neruda (p.89)
Trees planted by local people for local people.
 A simple but convincing solution offered by Eugen Schumacher. (p.111)
Literature (p.123)

Introduction to Part Three

Why theory ?

Readers of this handbook are not likely to have an education or teaching background. Instead, professional administrators or foresters may be assigned part time or full time to work with the public.

Even when a management plan provides some direction, it may not be detailed enough to focus the newly appointed and inexperienced educator's attention on reasonable objectives. As a result, educators fail to cut the overall goal into "bite-size pieces" and they never develop a strategy to achieve attainable objectives.

A newcomer to education may realize only after a period of trial and error that:

- Learning is not just the recall of facts, but means actively and creatively using new information.
- Information must be broken into manageable pieces that will challenge but not overwhelm the learner.
- Learners need the opportunity to relate new material to their previous experience and understanding of the world.
- Learners must be relaxed for real learning to take place. This does not rule out excitement.

Part three will give the educator a realistic view of what one can or cannot achieve and introduce him to practical action planning.

Working and often living with people who share a professional and personal interest in nature conservation, it is easy to assume that others should feel about conservation the same way, or that they would change their values and behaviour if only they knew what we know.

As educators we believe in the long term beneficial effects of education. As environmental educators we believe that by raising awareness and by teaching problem solving skills we can make this world a better place to live in. But how do we persuade others that the belief is based on more than wishful thinking?

If programs are designed to solve well defined problems, have plausible objectives, and address the appropriate target groups, they will get funded, show results, and convince the skeptics. Part three of the handbook will help you develop program alternatives with these qualities.

Environmental education or not ?

Labelling trees at a nature reserve with scientific and vernacular names.

Asking the public to throw refuse into the provided litter bins.

Conducting a survey of invertebrate fauna in a national park.

All of the above examples could be part of an environmental education program, but by themselves they are not environmental education.

traditional education versus environmental education

Environmental education (EE) is perhaps best explained in contrast to traditional, disciplinary education. The latter usually prepares one for functions in society. We are taught to become experts in an academic subject, operate a machine, or perform a service.

Traditional education defends rather than questions the existing societal value systems. An engineer is taught how to build a sewage treatment plant which copes with the effluents, but he is in no way encouraged to question the need for the industrial processes or consumption habits which cause them in the first place.

EE on the other hand aims at creating a citizen whose concern for the environment cuts across disciplinary boundaries and who is able to identify problems and suggest action which brings us closer to a solution.

Environmental education does not replace traditional education but complements it. Each educator's field of specialization has environmental aspects and is linked to other subjects. The reader's field of specialization is the rain forest, and environmental education presents it as part of a regional system and as linked to other systems.

Environmental education should solve problems .

Through EE people learn not only to react to growing pressure on the environment, but to anticipate and prevent problems. It promotes both technological and socio-cultural problem solving but is careful not to overemphasize the former. Technology is often required to fill a particularly urgent need or to ease us over a difficult period. Fertilizer and cement plants contribute to a reduction of food and housing shortages. Safe drinking water and proper waste disposal are prerequisites for public health.

technology and environmental education

A village woodlot planted with a fast growing hybrid tree variety uses modern plant genetics to take care of the village firewood needs five to ten years from now. But even the highest yield cannot alleviate local shortages of fire and construction wood if only a few are able to enjoy the benefits of the project, or if the villagers for some other reason do not consider it worthwhile. As a rule, technological solutions rarely work without some accompanying social change, and education should therefore dispel the naive belief in a technological wonderland.

Environmental education should promote technologies which promise to satisfy basic needs, but should warn against an infatuation with technology. It should draw attention to the risk and social disruption and division associated with some technologies, e.g. large monocultures or the nuclear industry.

Environmental education should promote low risk technology which utilizes local resources, creates jobs for the unemployed, and produces goods needed to satisfy basic human needs. In regard to forestry it would generally encourage low impact multiple use employing hand tools rather than bulldozers.

socio-cultural problem solving and environmental education

We have discussed values previously (p.27-32, 63-68) in a resource context. In this section and parts of the next we will see how values relate to education.

A society may stake its economic future on a high risk technology and find out later that it has to live with pollutants in its environment and the fear of disaster on the minds of its members. Precautions need to be taken, leaks need to be plugged, and experts are commissioned to discover technological solutions.

In hindsight people angrily demand answers to questions such as:

- Was there no alternative, maybe less profitable but not as risky?
- Why did nobody heed the warnings?
- Should we not have used the technology on a much smaller scale until we knew its impacts?

Acting on such questions not in hindsight but beforehand is socio-cultural problem solving. This type of problem solving recognizes that the problem most often is in the way people think, how they interact, and what they value, because that determines how they use technology.

If the engineers, foresters and development planners of a country think of the nation's rain forest only in terms of market value and export earnings, it is not because they are ignorant of other values but because their upbringing and traditional education has conditioned them to value these most. For the same reason they favour technological solutions.

Creative non-technological solutions are difficult to implement because they often brush against the grain of established values or call for sacrifice of some of the things people value. If education can influence the values of individual people and of societies it will substantially contribute to environmental problem solving. This influencing of personal and societal value systems is called values education.

Values education, however, does not inculcate "correct" values but instead sensitizes people to the possibility that a reordering of values might be required to cope with certain kinds of environmental and social problems before they even arise.

A Problem and Possible Solution

the problem	Shortage of fuelwood.
technological solutions	Reduce demand by building more efficient cooking stoves. Plant a village woodlot with fast growing species. Introduce alternative fuels.
socio-cultural solutions	Change societal values which prevent equitable allocation and distribution of the wood. Work towards an understanding of efficiency which makes sustainable use a prerequisite of efficient use. Encourage the cooperative and sustainable exploitation of common property resources.

personal value systems

A personal value system reflects one's upbringing and experience, feelings and emotions, surroundings and friends, knowledge and intellectual capabilities. According to their values people make judgements, buy things, argue in discussions, raise their children, vote in elections, or choose their friends. In fact, it is hard not to notice values if one is alert to them. Connected closely to beliefs and attitudes, values are expressed as preferences and choices.

If choices are primarily influenced by traits like intolerance, chauvinism, racism, and excessive competitiveness, it will be difficult to implement programs which require cooperation, tolerance, and sacrifice. Values education should therefore foster traits which are more conducive to solving the environmental crisis; e.g. a willingness to reduce consumption and accept some inconvenience, compassion, cooperation, and tolerance.

societal value systems

Societal and cultural values are widely accepted and shared by many or most members or segments of a society. They often become so deeply embedded in a society's value system that they are adhered to without the awareness even of other choices that exist. Many things are done because they have always been done that way or because everybody else does them the same way.

Culture and values are intertwined, and decisions are made and problems are solved in accordance with the predominant values of a culture. Environmental educators should ferret out and address values which are incompatible with environmental integrity.

One culture may place great value on preventing open conflict and postpone action on environmental issues if this would strain social relationships. Elsewhere action on environmental issues is frequently postponed if it would jeopardize economic growth.

rural versus urban values

We can often observe a fundamental difference in values between rural areas and cities and between economically advanced and less advanced countries and regions. Attitudes toward economic growth and how surplus is spent often provide clues as to what people value.

In the traditional rural value systems, economic and interpersonal relationships are not separated as much as in the economically more advanced countries or regions. Surplus is often spent to make merit or to provide entertainment for the village. This has no negative environmental impact and improves social relationships but does not yield interest in the narrow monetary sense.

The accumulation of wealth is part of the value system of western and urban cultures where problems are thought best overcome by economic growth and prosperity.

The rural poor are opting for the urban values, or so it seems, when they migrate to the cities and leave behind the security of the extended family. Are their hopes for a better life justified? Has life in the village become intolerable? Why? These are important questions for environmental education to deal with.

rational arguments versus moral judgement

The single-minded pursuit of economic growth in East and West alike results in the rapid exploitation of resources for often frivolous use and blocks creative and innovative approaches which suggest that other than purely economic considerations ought to influence decisions.

economic growth

There is hardly a government in the world which does not promote economic growth and development. Because the promises of economic development often do not match up with results the values behind the growth philosophy, e.g. prestige, conspicuous consumption etc. should be debated. Especially the purpose and kinds of economic growth need to be questioned.

justifiable and unjustifiable economic growth

A new set of priorities would allow growth where it is needed most and slow it where it serves only wants. By these criteria the growth of a fertilizer industry in developing countries should be promoted, but the growth of the pet food industry in the US and Europe should not.

The pet food industry can easily field arguments which demonstrate benefits of its business, e.g. jobs, taxes paid, healthy pets and happy customers. The arguments lose in importance, however, as soon as one asks the essentially moral question "What should have higher priority, food production for humans or for animals?".

an improved concept of economic growth

The definition of public interest should perhaps be based more on moral judgement and less on so called rational arguments. We should no longer trust the allegedly rational arguments without examining how they hold up against the ethical/moral side of the issue.

We should ask whether they sufficiently considered the interest of future generations, the welfare of the less privileged in society, and the survival of the plants and animals we are sharing this world with. Creating a critical and informed public, able and willing to do just that, is probably the main purpose of environmental values education.

values to encourage

Nurturing the belief of man over nature tends to encourage environmentally unsound practises relying on science to invent cures for every conceivable ill. Educators in natural resource management should of course promote value judgements in which humans are recognized as subject to ecological principles rather than as destined to bend nature to their will.

Values should be suspect if they assess the future only in terms of present day monetary value and ignore things unaccountable in this manner.

Values should also be suspect if the "interest of the economy" is placed above the welfare of local communities or tacitly assumed to be identical with it. This happens when, for instance, mangrove swamps are drained to get rid of mosquitoes for the greater comfort of tourists in luxury hotels nearby. The "interest of the economy" is likely to be a smoke screen which hides vested interests, while the local communities are deprived of badly needed wood and fish as a result of the draining.

Values are questionable if they promote economic growth per se without being explicit about how it enhances public welfare and distributes benefits.

As a protected area educator you are, of course, not expected to create single handedly the ideal citizen through values education. But although issues like economic growth and public policy are outside your immediate sphere of interest and influence, they are by no means irrelevant and, if at all possible, should be included in your environmental education programs.

summary

- Environmental values education about the rain forest should draw attention to how personal and societal value systems influence what the forest is valued for most.
- Environmental education should foster a far reaching awareness and concern for environmental problems, their causes and their consequences, and should question personal and societal values if necessary.
- In order to achieve long term solutions to environmental problems, values education should be deliberately incorporated into educational programs for protected areas.
- Environmental Education should instill in the learner a feeling for and a rational understanding of environmentally sound values and draw attention to environmentally unsound values, preferably in a problem solving context.

Who will come to the rescue ?

Imagine you are drowning. When is it more likely that someone will come to the rescue?

(a) When one good swimmer is nearby?

(b) When five good swimmers are nearby?

The answer is (a) because the person does not share responsibility with anybody else. If several people arrive at the scene each individual feels less responsible because, after all, there are others who could jump into the water too.

Similarly, solutions to not only environmental problems are considered the responsibility of others; the expert, the appropriate agency and technology are trusted to come to the rescue.

The belief in technology runs deep. It is continuously reinforced by spectacular and impressive technological achievements and therefore seems justified. It is also convenient because the greater the trust in the expert and the technological solution, the smaller is each individual's share of responsibility.

The Learning Domains

Why theory ?

Communication theory says that people like to scan a text for information that is interesting to them. For this reason the narrow column in this handbook is reserved for important captions which are further accentuated by bold print. Observing principles derived from theory increases the probability that people will receive, understand, and accept your message.

Learning theory is a vast subject which is here limited to a discussion of the learning domains.

What promotes desired change ?

A person adjusts his value system when he receives enough stimulation in favour of the change. Change is likely to occur if ....

- Evidence accumulates suggesting that change is inevitable.
- One feels that the proposed change will constitute an improvement.
- One is able to bring about or cope with the desired change.

Roughly, these three considerations correspond to the learning domains: the cognitive domain, the affective domain, and the skill domain. In the cognitive domain the educator provides evidence which speaks for change. In the affective domain he persuades people to want the change to happen, and by instruction in the skill domain the learners are prepared to deal with it.

You will increase the chance of success if your education program addresses all three learning domains. In practise this means that you should have a spread of arguments, activities, and materials which cover each of the three domains.

cognitive domain

This is the domain of rational thought and quantitative reasoning. Learning in this domain resembles scientific inquiry, and reasoning is done on the basis of hard, verifiable facts. A typical argument is this: "The poor quality of the soil and the steepness of the slopes require that forest cover be maintained." You would ask "How reliable are the data?" or "How reasonable are the assumptions?" The analysis of a TRF in southern Thailand on page 69/70 is an example of reasoning in the cognitive domain.

teaching techniques

workshop = a series of meetings for intensive study, work, discussion in some field.

This domain should be the least problematic for the educator in terms of teaching techniques because it calls only for straightforward imparting of knowledge in the accustomed ways through lecture, printed materials, documentary films, surveys, workshops, statistics, experiments, monitoring, etc.

affective domain

This is the domain of feeling, emotion, and qualitative reasoning. Advertising often exploits people's receptivity in this domain by associating a product with positive feelings. Learning in this domain fosters awareness and sensitivity, and environmental education appropriate to it should raise questions of moral right or wrong and emphasize the intangible values of ethics and aesthetics.

Learning in this domain elicits responses such as "We are responsible to future generations for the condition of the world as we pass it on to them". The introduction to the handbook has been written to appeal mainly to the affective domain.

teaching techniques

The educator is probably less familiar with teaching techniques in this domain. In preparation for a more in depth treatment the learners should first be given an opportunity to develop positive feelings about the rain forest and its species. This preparatory phase is sometimes called acclimatization.

getting to like the forest

For this purpose you can take them on a nature walk and point out interesting relationships between the forest species. You can encourage them to observe wild animals or captive animals if suitably presented. In other settings, tending a garden, listening to a vividly narrated experience, or reading a book may be more appropriate. Sometimes art appreciation will create the desired positive feelings or just plain relaxation in the pleasant surroundings of a rain forest setting. Experience and a knowledge of the people you work with will tell what approach to use with which group.

discussion

An open discussion should follow if at all possible. It should probably revolve around an issue of local concern and refer to material taught previously in the cognitive domain if essential for the discussion. In the discussion, rational arguments should be deemphasized and participants should be encouraged to pay attention to how others feel about the issue and to why their opinions may be different.

It is extremely important that nobody should in any way be penalized or slighted because of an opinion he holds and expresses. The discussion builds on the premise that everybody is entitled to his opinion and the educator cannot claim authority or monopoly in determining good or bad values.

It is hoped that learners will, as a result of the discussion, question value judgements based on inadequate premises or immoral reasoning. If they do not, there is reason for the educator to reexamine the process and methods as outlined in the section on action planning (p.103).

If this approach appears to leave too much to chance, consider the alternative. Exhortations and preaching of "proper" values most likely go in through one ear and out through the other. Discussions can, of course, be conducted in a different manner, be more planning and fact oriented, but then they will no longer fulfill the requirements of teaching in the affective domain.

getting to know each other

Learning in the affective domain also means acquiring the ability to empathize with the plight of others. For this purpose a U.N. agency arranged seminars where high level administrators, unskilled labourers, bankers and business people came together for a week as equals. It was difficult to break down the social barriers between them, but shut off from the outside world and sharing rooms and meals together, they could hardly avoid talking to each other.

Bank manager X knew all along that people from the slums have a hard time making ends meet. But it is different hearing a woman talk about how she hawks lottery tickets on the sidewalk and does the laundry for the wealthy who live only a stone's throw from the wood and cardboard shack that is home for her and her three children. Personal accounts like these are more "moving" than the most impressive statistics.

There may not be many rich people who voluntarily put themselves into a situation like the above. If they do, they cannot help but question their values which allow them to spend on one evening's entertainment what the poor woman earns in a month, working her fingers to the bone.

High level administrators tend to gain their first hand impressions of village life from the passenger seat of a Land Rover. They may become more sympathetic to village problems if given the opportunity to enjoy themselves at village festivities and to talk informally to the local people.

moral dilemma technique

You may try the moral dilemma technique if you are in a position to teach relatively small groups in seminars, workshops, or repeat visits to schools.

The moral dilemma is presented as a real or hypothetical conflict situation which has no obvious right or wrong solution but must be resolved by personal value judgement.

In a moral dilemma exercise the participants should not argue in terms of what is correct or incorrect in verifiable terms, but argue on the basis of their own ethical/moral convictions. Such issue oriented discussions are bound to be lively. The participants strongly identify with some values, oppose others, and are sometimes confronted with new ones. The exercise provides them with an opportunity to hear different arguments and come to respect, if not to adopt,different viewpoints.

The participants should receive some preparation in the cognitive domain. For the case below they would need some background information about the relative scarcity of local wildlife, protection laws etc. The discussion of the moral dilemma itself should proceed in a relaxed atmosphere in which the participants do not hesitate to voice their opinions.

Here is an example:

Thong Thairat's dilemma

Thong Thairat is a professional hunter in the Banthat Hills of southerm Thailand. He has no land of his own and no education or skills which would allow him to find a job other than as seasonal help during rice planting and harvest. Perhaps he could be hired as a rubber tapper, but that does not pay too well and, anyway, Thong likes the independence of his present occupation,which enables him to make a decent living for himself, his wife, and six children between the ages of two and twelve.

Thong shoots wild pigs and barking deer which are still abundant in the area. He sells the meat in markets or to "jungle food restaurants", and if he can capture a baby monkey he sells it to a live animal dealer.

Two years ago the area where Thong goes hunting was declared a wildlife sanctuary. Ever since he has hunted illegally,but,knowing the forest as well as he does,he is not afraid of being caught.

Tapirs are becoming rare and they are on the country's endangered species list. It is a special day when Thong can shoot one. The meat is highly prized and there is a lot of it on just one animal. In a remote pocket of the hill country Thong has seen tracks of rhinoceros. He knows that they are protected and that there are only three or four at the most in the whole sanctuary.

One day he surprises a rhino in its wallow. If he shoots it he could sell the horn and the carcass for more money than he would normally earn in two years. With the money he could buy a plot of land and start a Durian orchard and eventually give up hunting altogether. Should he pull the trigger or not?

discussion of moral dilemma

The discussion should revolve around the "why" or "why not" of the following questions:

- Is it alright for Thong to shoot wild animals to support his family?
- Is it still o.k. if Thong shoots the animals in a protected area?
- Is Thong justified to shoot tapirs and rhinoceros inside the protected area? Outside the area?

opposing values in moral dilemma

The exercise pits ethical against economic values and it helps the participants distinguish between moral and legal justification. The prevalent opinion could well be that Thong is morally justified to shoot abundant animals even if this is against the law, but that his shooting of tapir and rhino is legally and morally to be condemned.

A protected area educator may be tempted to ensure that the discussion will condemn poaching in a protected area for whatever reason. This however is not the purpose of the moral dilemma exercise. The moral dilemma should not indoctrinate the learner but induce him to examine critically his own value system. It is hoped, of course, that learners voluntarily make the desirable adjustments.

behaviour modification

Behaviour modification through incentives expedites change. People respond to the promise of a reward, and, if the resulting behaviour change lasts, they will probably adjust their value system accordingly. The promise of secure use rights, for example, could motivate people to abandon destructive practises and adopt more positive feelings about forest protection.

Tangible incentives are a prerequisite for public participation programs and they would certainly be appropriate in obtaining Thong Thairat's cooperation. Thong should either receive a permit for hunting the abundant species, or else he should be employed as a ranger, a position in which he could use his skills and intimate knowledge of the terrain to his own advantage and that of the protected area.

The endorsement of a conservation program by prominent members of a community motivates others to jump on the bandwagon. As a program gains credibility it becomes respectable, and joiners can bask in the warm feeling of certainty that those higher up approve of their action.

Behaviour modification also takes place if someone can be persuaded to do something, e.g. come to a meeting. Persuaded, or talked into some action if you will, one has to justify one's action before oneself and one's friends.

In general, be aware of how you can best motivate people, but avoid using behaviour modification techniques as a bag of tricks from which you choose one to achieve a particular desired result. Doing so reeks of manipulation and people will resent you as soon as they notice.

skill domain

Learning in this domain renders a person competent to participate in change and equips him with practical skills, such as building a cooking stove which uses less wood, recycling materials, or communicating concerns to politicians and other decision makers.

Merely being aware of a problem and knowing of its seriousness does not resolve it. The awareness and concern created by the educator should merge into positive action. Skills should therefore relate to problem solving. Measuring water quality, for instance, is the first step towards a clean-up.

Skills should be transferable to the home environment. The ability, for example, to identify endangered species enables learners to recognize illegally traded wildlife in markets, restaurants, and animal shops. If additional skills are taught, other action might follow.

action learning

Action learning is an excellent method for teaching skills and is readily combined with learning in the other two domains. The planting of trees in a village wood lot by children will satisfy their firewood needs when they are adults. The planting of the trees is a prudent foresight which will pay off in the future. It can also be an enjoyable activity which leaves positive feelings associated with local conservation action. By transferring the theory of the handbook to the real world situation of your forest area, you are doing action learning.

summary

- Teaching is most effective if it is in all three learning domains.
- Hard evidence and factual reasoning are characteristic for the cognitive domain. Teaching techniques and materials include lecture, text books, and statistics.
- Ethical arguments and an expression of feelings are characteristic for the affective domain. Teaching techniques include acclimatization, open discussion (moral dilemma), and behaviour modification.
- Teaching practical skills is necessary for concern and awareness to be expressed in action. Action learning is a good method for teaching in all three domains.

suggestions

Think about education tasks in your area and devise possible methods to convey your message. Group the latter according to learning domains. For now, do not worry about budget and time constraints, but stay within what appears reasonable in your situation. If you need inspiration, see the activities on p.109/10.

Writing in the Affective Domain

The saws cutting the huge logs ground out their shrill lament all day long. First you heard the deep underground thud of the felled tree. Every five or ten minutes the ground shuddered like a drum in the dark at the hard impact of crashing rauli, maniu, and larch trees, giant works of nature, seeded there by the wind a thousand years before. Then the saw sectioning the bodies of these giants struck up its whine. The metallic sound of the saw, grating and high-pitched like a violin, following the obscure drum of the earth welcoming its gods, created the tense atmosphere of a legend, a ring of mystery and cosmic terror.

The forest was dying. I heard its lamentations with a heavy heart, as if I had come there to listen to the oldest voices anyone had ever heard.

PABLO NERUDA
memoirs

What kind of education you will be offering depends on the expectations of the employing agency and to some extent on your own understanding of its objectives.

An educator at a protected area performs in any or all of the following roles. Usually an educator will act in more than one role, and one should be aware which role is neglected or overemphasized.

environmental education role

(a) In this role, teaching deals with environmental issues which, directly or indirectly, relate to the protected area. Environmental education by the protected area educator should always involve the area but not necessarily revolve around it. It often entails close cooperation with government officers, local communities and resource users, or educators in universities and schools. In-depth treatment of issues, values education, and prearranged sessions are also characteristic for this role.

Environmental education can be and should be combined with other task areas, but requires a commitment whose need may not be obvious to the agency.

public participation role

(b) In this role, the educator organizes and monitors cooperative programs between the administration and the local people. The educator could become a mediator or a contact person between the administration and the public and one of his main tasks would be to build an atmosphere of trust and mutual understanding. If conservation should also be perceived as in the interest of the public, then this role will be of increasing importance in the future.

Agencies occasionally send educators into villages, where they provide some entertainment in the form of audio visual aids, hold a brief pep talk and leave. Such public relations efforts should not be mistaken for the mediator role which requires a long term commitment to cooperation, compromise, and an understanding of local needs.

public relations role

(c) In this role, the educator is expected to polish the image of the employing agency. In order to enhance the agency's reputation, he conducts highly visible events, produces impressive facilities and glossy publications, publicizes achievements and downplays failures.

Sometimes expensive visitor centers or wildlife collections are passed off as facilities for ir-depth education, where in fact they are monuments to the greater glory of the department. The real test whether or not facilities are used as educational tools lies in the budget allocations which follow the initial investment. The educational value is negligible if there is barely enough money for maintenance, let alone for programs and personnel.

visitor management role

(d) In this role, the educator averts conflict between visitor use and other management objectives. This includes informing visitors of rules and regulations, ensuring their safety, and providing the services and programs people expect.

This role is stressed where public recreational use has high priority. Problem solving in this role is as much for the convenience of management as it is for people's enjoyment of their visit. Leading recreational activities, explaining the need for certain rules and regulations, and interpretation of natural features are typical tasks for the educator.

If environmental education is taught in this role, then it is usually in the form of interpretation that relates wildland resources to people's lives. Interpretation does not qualify as environmental education when it either lacks the problem solving aspect or when it is too narrowly focused on the protected area and its fauna and flora.

support or lack of it

You will find that you will receive most support from the employing agency for your activities as a public relations agent or facilitator of visitor management. This is not surprising, as the payoff for the agency is clear.

The results of EE are difficult to demonstrate without ambiguity. Changing personal and societal value systems is slow, and not achieved by education alone. The rewards of employing an environmental educator for the agency are uncertain and most probably delayed. For that reason it may be easier to squeeze blood from a stone than to receive funding for activities as an environmental educator.

Involving the public in decision making is often a cumbersome procedure which carries only an uncertain promise of smoother relations in the future. So here too the agency has to contend with delay and possible complications. It has to become flexible where it used to be rigid and, entering an untried field of operations, uncertainties loom larger than the expected rewards.

overcoming lack of support

The focus of the educator's work should of course be on the problems which people cause for the protected area, but it is important that the employing agency's understanding of the term not be so narrow as to preclude innovative approaches and long term solutions which benefit local communities. The agency should especially allow the educator to do values education and to maintain close contact with the local people.

The first item on the educator's agenda may be to persuade the administrators of the need to include public participation and environmental education in the task areas of the educator.

Some reluctance to finance these areas may be overcome by initially submitting only low risk and low cost program options and to proceed to more ambitious projects after the earlier ones have been successfully completed.
Also, expected benefits should be stated in no uncertain terms. An objective like "creating concern and awareness of the consequences of forest destruction" is not enough and should at least be supplemented with a statement of rewards in concrete terms.

The following objective is better: "Provide incentives and motivation to eliminate or progressively reduce encroachment in area X within the next five years". This objective offers a specific reward, but is flexible enough for adjustment as the situation requires. Read more about the important subject of objectives on pages 103 and 115.

Government agencies like programs which reflect well on their activities and improve their image. If the program puts the agency into the public limelight, is affordable and not too risky, the probability of approval is high. An essay or art competition is an example. It can be turned into a media event but will also serve as a starting point for serious environmental education. Likewise, agency participation in local events can prepare the ground for cooperative problem solving in the future.

If you manage to obtain favourable media coverage, people are more likely to listen attentively to your next proposal. In the beginning, particularly, it is probably best to submit only those proposals which you know will be well received and are likely to succeed.

working within the "system"

Many civil servants, protected area personnel not excluded, experience frustration over not being allowed to do what they know needs to be done. Support is a long time in coming. Suggestions are met with polite disinterest. These problems are common to all bureaucracies, and you might accept them as unalterable if all you want is to collect your monthly pay check.

If there are obvious and promising opportunities for action at your site, by all means do not succumb to widespread lethargy after your first futile attempt to rally support. Enthusiasm, drive, and commitment may be rare in the civil service, but they are not extinct. Approach people who share your concerns and try to organize programs together.

Together you are able to ruffle feathers with greater impunity, and, although none of you may be very senior, you have one decisive advantage over the mass of inactive pay check collectors. With a minimum of support, you can get things done and demonstrate achievements. If you play your cards right, it is often possible to work at the fringes of the system, inside its margin of tolerance, and effect change from within.

Spiteful individuals occasionally put obstacles in your way. Ignore them if you can tolerate the inconveniences involved. If they sit on the money bag or have some other position in which they are difficult to avoid, file an official complaint, provided your case is strong and a relatively unbiased judgement can be expected. If you cannot get a fair hearing and a minimum of support, maybe you can get a transfer.

common problems

Educators at protected areas earn their keep mainly by designing education programs to counter day to day problems associated with a protected area, and it is these problems which become the starting point and the core of action.

Visitors litter, disturb wildlife, and damage vegetation. Locals clear and burn patches of forest, and gunshots may be heard frequently. Business interests seek to weaken protection to allow mineral exploitation. The land resource department looks to your reserve to resettle people displaced by the rising water of a reservoir. Pleas to the administration to change policies or regulation fall on deaf ears. All of these are problems which could become the subject of an education program.

Problems are serious if they interfere with attaining primary management objectives which set definite priorities for managing a protected area. The answer to the key question "What are the main obstacles to achieving management objectives?" then provides us with an objective method for naming the problems.

Yet, one should be aware that if management objectives are at cross purposes with local needs, and no alternatives are offered, no amount of education will resolve the inevitable conflict.

problem categories

Most problems fall into any one of five categories.

- Encroachment:
  e.g. forest clearing, trapping, collecting.
- Inadequate Protection:
  e.g. lack of a buffer zone, ineffective law enforcement.
- Inadequate Management:
  e.g. lack of management plan and resource information, lack of environmental monitoring.
- Inadequate Public Support:
  e.g. lack of public participation in deciding on management objectives, regulations and permitted uses; hostility or indifference toward protected areas; low awareness of protected area values.
- Inadequate Administrative Support:
  e.g. low commitment of budget and manpower to education and environmental monitoring.

making problems manageable

If a problem appears intractable, you can try to reduce it in size and complexity. For the general term "encroachment" you could substitute "the trapping of endangered mammals at location such and such", and be more precise about defining and locating the problem. So, if you cannot solve the whole problem in the whole area maybe you can do so for part of it in part of the area.

Scaling down raises the probability of success because it concentrates resources. Unfortunately it does not always work. For instance, to eliminate the market for endangered species all dealers in the region need to be persuaded. Those who refuse to enter an agreement might obtain business others voluntarily abstained from.

You can often increase the probability of success if you restrict an intervention to situations which are particularly urgent or to places where it promises to show the best results. At the Khao Banthat sanctuary two areas stand out for obvious treatment, but you may decide to gain experience in a smaller area first. (see below)

If you choose to treat just one area, you are no longer confronted with an amorphous encroachment problem everywhere in the reserve, which makes you feel overwhelmed by the task. Instead you can offer a series of options with distinct payoffs if the project is implemented successfully.

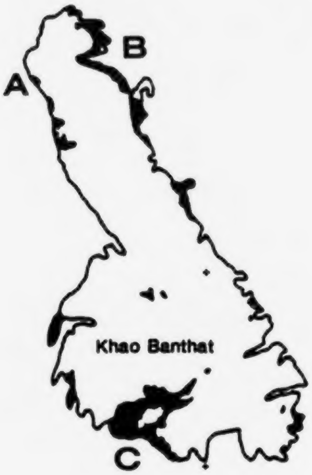
an encroachment problem

The figure shows the outline of the Khao Banthat Wildlife Sanctuary, with areas affected by encroachment indicated in black.

Area "A" is one of the small and isolated patches of encroachment. It is near the sanctuary headquarters and could be used to develop an intervention which could later be applied to other, larger areas.

In area "B" clearings proceed westward on a long front. Shifting cultivation is practised mostly on steep hillsides, affecting the water quality and flow of numerous feeder streams to irrigated rice agriculture.

In area "C" shifting cultivation is practised on the only significant low and flat land portions of the sanctuary, and has reached the very heartland of the reserve. If clearing continues the sanctuary could eventually be cut in half.



treatment options

Following are treatment options based on the example. All three options reduce encroachment by forest clearing to specific locations.

Option One:
A pilot program to reduce shifting cultivation in area "A" of the Khao Banthat sanctuary.

Option Two:
A program to reduce shifting cultivation in area "B" of the Khao Banthat sanctuary.

Option Three:
A program to reduce shifting cultivation in area "C" of the Khao Banthat sanctuary.

You are likely to choose option one if you have no experience and limited resources. Options two and three are major undertakings which require experience and cooperation by more than one government agency. The choice of one over the other depends on the likelihood of cooperation by the local people and on the priorities set by the management objectives.

If the ecological integrity of the sanctuary has highest priority, then the choice should be option three. If damage to downstream irrigation agriculture is imminent and therefore most urgent, then the choice is obviously option two.

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summary

- The educator's main task is solving people related problems of the protected area.
- Treatment is often more successful when it is concentrated in specific locations and on specific problems.
- All obstacles to achieving management objectives are considered problems.

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suggestions

For your area try to find problems appropriate to the problem categories listed on page 94.

If there is no management plan which states explicit objectives for your area, see if you can find appropriate objectives among the standard and generally accepted objectives for wildland management listed on the next page. Carefully read the management objectives and evaluate how important they are or should be in your area.

defining management objectives

Write a (1) in the space provided if you feel that the objective is or should be dominant throughout the area.

Write a (2) in the space if you feel that the objective is or should dominate specified portions of the area.

Write nothing if the objective does not apply or is achieved as a byproduct of the objectives marked (1) or (2).

A (   ) Maintain sample ecosystems in natural state.

B (   ) Maintain ecological diversity and environmental regulation (of natural processes).
C (   ) Conserve genetic resources.

D (   ) Provide education, research and environmental monitoring.
E (   ) Conserve watershed forests.

F (   ) Control erosion/sedimentation and protect downstream property.
G (   ) Produce protein (meat) from wildlife; sport hunting and fishing.
H (   ) Provide for recreation and tourism.

I (   ) Produce timber on sustained yield basis.

J (   ) Protect sites and objects of cultural, historical, and archeological heritage.
K (   ) Protect scenic beauty and green areas.

L (   ) Maintain open options through multipurpose management.
M (   ) Support rural development through rational use of marginal land and stable employment.

Listed on the next page are a range of management categories and designations together with their appropriate management objectives. Compare your list with the objectives of different designations and see which one comes closest to your description. Does it agree with the actual designation?

solution

Management Categories	A	B	C	D	E	F	G	H	I	J	K	L	M
National Park	1	1	1	2				1		1	1		1
Natural Monument	1	1	1	1			2	2			2		2
Scientific or Biological Reserve	1		1	1									2
Nature Conservation Reserve	1	2	1	1							2		2
Protected Landscape	2	2	2	2	2			1	2	1	1		1
Resource Reserve		2										1	
Anthropological Reserve	1	1	1	2						1			2
Multiple Use Mgmt. Area		2		2			1	1	1			1	1
Biosphere Reserve	1	1	1	1						2	2	2	2
World Heritage Site	1	1	1	1				1		1	1		2

A	Maintain sample ecosystem in natural state.
B	Maintain ecological diversity and environmental regulation.
C	Conserve genetic resources.
D	Provide education, research, and environmental monitoring.
E	Conserve watershed forests.
F	Control erosion, sedimentation and protect downstream property.
G	Produce protein from wildlife, sport hunting, fishing.
H	Provide for recreation and tourism.
I	Produce timber and forage on sustained yield basis.
J	Protect sites and objects of cultural, historical or archeological heritage.
K	Protect scenic beauty and green areas.
L	Maintain open options and flexibility for multiple use management.
M	Stimulate rational use of marginal lands and provision of stable employment opportunities.

(source: IUCN, Categories, objectives, and criteria for protected areas)

IUCN= International Union for Conservation of Nature and Natural Resources

A group of people can become the subject for education, a target group, if it has an impact on the protected area. We choose target groups mainly because they cause problems and/or are able to solve them. The key question to ask is this:

Which target group is, wholly or partially, responsible for or able to solve a specific problem?

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target group characteristics

It is useful to characterize target groups by their attitude towards the protected area because it tells much about the hurdles that need to be jumped before the educator's message can have an effect.

- Target groups with a negative attitude towards the protected area. Most are involved in practises conflicting with management objectives which were probably established by scientists without the benefit of local input. These groups may be difficult to persuade but need to be reached in order to achieve long term solutions.
- Target groups without strong feelings about the protected area. This group is generally more accessible to arguments not backed by incentives.
- Target groups sympathetic to protected area concerns. These people will probably lend their active support if given an opportunity to do so.

Target groups can also be characterized by their actual or potential economic impact on the protected area, by their private and professional interest, by where they live, and cultural/educational background.

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major target groups

Following are major target groups and some of their characteristics:

village people

With little schooling and no professional training, people in this group make their living from the land. Most are engaged in shifting cultivation, hunting, trapping, or collecting of forest goods. For some this constitutes the major income; for others it is supplementary.

The attitude towards the protected area ranges from indifferent where no law enforcement attempts are made to hostile where fines and restrictions have been imposed. This group is not generally part of the visiting public.

collectors and traders

Members of this group profit from extractive uses of the forest which sometimes could continue on a sustainable basis but which are in practise often destructive. This group needs to be informed about endangered species, trade restrictions, and seasonal permits, if these are issued.

Although people in this group are likely to have a negative or at best indifferent attitude, one may be able to persuade them individually because there are only few in any one area.

professionals and administrators

The group of people in administrative, professional, and managerial positions is small but influential, and most highly concentrated in the urban centers. This varied group includes local opinion leaders, business owners, government executives, and civic leaders with power in natural resource decision making. Active conservationists often come from this group.

Better educated and prosperous, representatives of this group most actively promote economic development which may pose potential threats to the protected areas. Their professional goals often align them with the interests of industry, and they tend to favour uses which benefit the privileged, and ignore questions of equity.

agroforestry=

Combining tree and cultivated crops, forestry and agricultural practises simultaneously

Senior administration officials typically promote single uses of the forest resources (e.g. timber) over multiple uses (e.g. agroforestry). They decide on policy, budget, and management objectives which indirectly determine the size and thrust of an educational program. Until we have evidence to the contrary, we can assume that people in this group are convinced of the value of protected areas. They may not, however, sufficiently appreciate what an educational program could achieve, or may be oblivious to local resource needs.

Except for some individuals, people in this group have no vested interest in the rain forest and indifference could switch to a favourable attitude towards the protected area as a result of education.

message multipliers

teachers and students

Some target groups do not impact on the protected areas in specific and quantifiable ways, but they are instrumental in forming public opinion. Large and important segments of the population can be reached through the communication links from teacher to students to parents and friends. A program for this group ideally establishes institutional ties to schools, universities, and research establishments.

Cooperation between the protected area educator and teachers would ensure that knowledge of the values of the rain forest is widely disseminated. It is expected that this will motivate the students to consider environmental and social concerns when they make natural resource decisions later in their professional careers.

media people

Almost every household owns a radio set in many rain forest areas, newspapers are available, and even television has been introduced to some. Contacts of the protected area educator with the media would increase coverage reflecting a positive attitude towards sustainable and equitable use of rain forest resources.

village headmen

Village headmen may not share the formal educational background of others in this large group, but they are knowledgeable all the same, and influential in the villages. A successful program would convince them of the ecological values of the rain forest and of the advantages of cooperating with the protected area administration (if the cooperation is sought by the administration and provides tangible benefits for the village).

law enforcement personnel

To a degree law enforcement depends on the attitudes and knowledge of the police. Programs for better recognition of endangered species and knowledge of the pertinent laws could sometimes result in more frequent and vigorous prosecution of offenses, not only of the poor and powerless.

Local power structures are generally more decisive in whether laws are enforced or not. Where powerful individuals, motivated solely by personal gain, can pay off a corrupt bureaucracy and police force with impunity, education programs calling for social change are likely to be blocked. Publicity and exposure are usually the educator's only recourse.

members of associations and clubs

Prominent members of the urban communities are frequently members of associations and clubs where they can be addressed at appropriate occasions. It is often possible to obtain financial or material support for specific projects and activities, as well as to convey the concerns of other groups which are unorganized and "voiceless".

working people

People in this large but amorphous group have little direct impact on the rain forest or influence on how it is exploited, except when they are organized. Trade unions can be powerful supporters or opponents of conservation. Individuals of this groups are probably best addressed as members of the visiting public.

visiting public

The visiting public demonstrates a fundamental interest in the protected area whether they are there on invitation by the educator for an organized visit or coming on their own and solely for recreation. Invited visitors belong to one target group and visitors who come on their own to another. Programs for the latter would probably best focus on optimal and non-damaging use of natural surroundings and facilities.

suggestions

Refer to the list of problems which you identified for your area and find the right target group(s) for each.

- State the problem and list the groups which cause it and/or could influence a solution.
- For each group state how it causes or aggravates the problem and how (realistically) it could reduce impact or otherwise contribute to a solution.
- Write a short paragraph about the general characteristics of each group (educational background, location, age, sex, etc.). Stick to what in your opinion is most relevant and keep it short.

Action Planning

Every program passes (or should pass) through three distinct phases.

In the planning phase we lay down what we want to achieve and how.

In the implementation phase we put the plan into action.

In the evaluation phase we verify to what extent we have met objectives and how we could improve future action.

planning

implementation

evaluation

(verifiable) objectives

Objectives which someone sets so that others perform according to prescribed standards are different from objectives which people set for themselves. Objectives of the former kind are for accountability rather than the achievement of best results under prevailing circumstances.

Unimposed and flexible objectives are more sensitive to the demands of the situation than directives handed down by someone outside. Environmental education promotes voluntary cooperation for which objectives are best set by the participants, and adjusted by them as the project evolves.

Assume that you are planning to conduct regular workshops for teachers at your rain forest site. You intend the participants to relax and enjoy themselves in the beautiful outdoor setting. You also expect them to learn a few facts about the regional status of the forest and its economic resource values, but most of all you want them to identify and question personal and societal values which impact on the rain forest, and discuss methods to deal with these values in the classroom.

How do you express all this in the form of verifiable objectives?
The answer is, you don't.

You could test the participants on recall of facts learned, but any attempt to measure a change of attitudes would be so contrived as to be virtually meaningless. Worse still, the participants would feel they have to live up to something and clam up in discussions.

The purpose of the workshop goes deeper than the learning of facts. It is the sparks that fly during the discussion, the gradual understanding of one another, the discovery of underlying causes, the opening up to other views, and the expansion of intangible and ecological values of the rain forest in the individual's personal value system.

You can sense when all of this happens, but you cannot will it or expect "techniques to do the trick". As a facilitator you can create the conditions which, by your experience and knowledge of the participants, are most conducive.

"Well", says your employing agency, "how can we be sure that you are not organizing vacations for your teacher friends at our expense"?

Bureaucracies, like any other complex organization, require control, predictability, and conformity. They insist on verifiable objectives and a quantification of the unquantifiable. You are in trouble if, filling out a form in quintuplicate, you notice that the project you propose does not fit any of the given categories.

With some creative thinking it should be possible in most cases to make an innovative and therefore suspect project look like an ordinary one, and to come up with objectives which satisfy the bureaucrat's craving for predictability, replete with the catch words currently in vogue.

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reflection in action

The planning of even short term and apparently simple interventions can become quite involved, as you will realize. What can go wrong probably will. Assumptions turn out false, expected support does not materialize, and obstacles (but also opportunities) arise unexpectedly.

You will feel less overwhelmed by a task if you are pragmatic and admit that you cannot know now whether a certain planned action will bring you closer to your goal. You can, however, try out promising approaches and monitor and evaluate progress at short intervals. With the experience gained you can adjust the action plan or maybe even your objectives.

This approach is sometimes called "reflection in action" because you reflect on your actions as you go along, and let the conclusions influence the next action step.

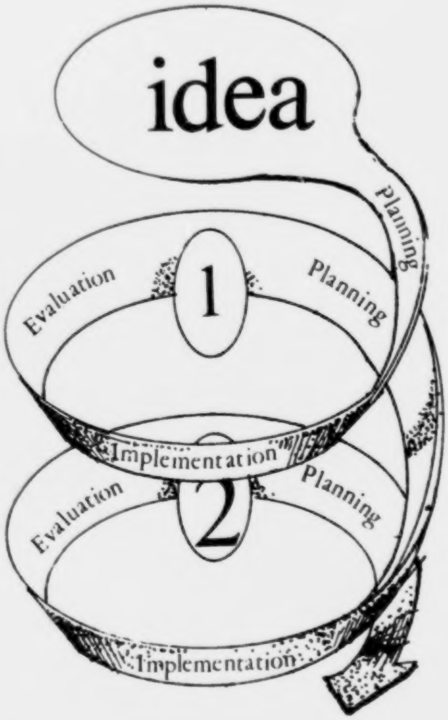
(a) You start with an idea and expand it into a general plan that includes a detailed plan for the first action step.

(b) You implement the first action step and record what happens.

(c) You reflect and evaluate what happened in the first action step.
Did I find what I intended to find out or achieve what I intended to achieve?
Did the plan work partially or not at all?
Why or why not? Should I try again with changes?
Are there more promising alternatives for step two?

(a) You revise the general plan and prepare a detailed action plan for action step two.

With this method you do not spend an inordinate amount of time and energy on planning details which may later turn out to be irrelevant. Instead you develop a reasonable plan, fully knowing that it is not perfect, but you begin to examine results and experience very soon after you start implementation, and learn from past mistakes.



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ideas for action

Every action plan begins with an idea about how to solve a problem or improve an existing situation. As long as the desired achievement is modest, action is probably feasible and success likely.

Here are some ideas which can be followed up in a matter of weeks or months without the need for much manpower and money.

examples

When sighting animals in the wild, visitors frequently comment on how good it tastes in the pot, and the subject is readily picked up by the others. How can I get them to forget the culinary delights and instead admire the adaptations of the species to its rain forest environment? Would some brief comments on meat hunting help? But what if I am not there?

Local merchants seem to be willing to give financial and material support to education projects at the protected area. I should find the best ways to approach them (through introductions maybe, or on the occasion of club meetings?) and find out which kinds of project they are most likely to give money for.

When I tried to establish contact between the reserve administration and the local people, I felt that the locals gave me the answers they thought I wanted to *hear. Before trying to establish any kind of cooperative arrangement with them I need to find out the reasons for this reluctance to speak their mind. Is it because of myself, previous actions by the administration, or other reasons?*

Casual visitors rarely use the nature trails and animal observation blinds. School groups usually do hike the trails but they are noisy, leave the trail, or organize picnics in the blinds despite signs advising to the contrary. Shy animals leave the area because of the disturbance, and the visitors are disappointed because they see no wildlife. Could the situation be improved by better preparation of groups by their teachers?

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first cycle – action step one

Somewhat condensed, the first two cycles of an intervention could look like this:

idea

Casual visitors rarely use the nature trails, and, after talking to a number of them, it seems that most are unaware that trails for public use exist.

planning

General Plan
Inform people of the existence of nature trails in order to increase use.
Action Plan One
Arrange for signs to be produced by maintenance crew. Indicate trail heads on the large area map at the entrance. Stake out locations for the signs at all turnoffs and intersections.
If five or more visitors will use the trails in one hour on a busy day, usage will have improved considerably.

implementation

Action
Set up signs at marked positions and check for visibility from all approaches.
Monitoring
Observed trail heads on busy days and counted the number of users. I noticed between 4 and 16 individuals or small groups per hour come up to each trail head, but only a few of those actually walked the trail.

evaluation

Most of those who turned back gave either of the following explanations:

- *They were interested in the trail but did not know what to expect or if it would be worthwhile.*

- *They were not sure how long it would take them to walk it.*
- *The trail looked like it might be too difficult and uncomfortable to walk.*

It looks like more people will walk the trail if they knew what to expect, how long it would take them, and if they were confident that it is not too strenuous. We can probably convey all of this information with signs if we make the necessary changes.

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second cycle – action step two

planning

Revised General Plan
Inform people of the existence of nature trails, their prominent features, and the time it takes to walk them.
Action Plan Two
Provide information about the features along the trails and approximate walking times on the area sign and the trail heads. Smooth out rough spots on the trails and widen entrance to the trails.
Most people who arrive at the trail head should walk the trail.

implementation

Action
Installed new informative signs at the trail heads and remodelled area sign. Widened trail entrance and smoothed out rough spots.
Monitoring
Observed trail heads on busy days. Most of those who arrived actually walked the trail.

evaluation

The additional information about the trails really made a difference. Of course we still do not know how well the people liked the trail, and if they would come again or recommend it to others. I think we should ask people as they leave the trail and ask them about what they liked and what they did not.

As soon as one begins to actually embark on a project it becomes obvious that each phase requires attention to details and leads to other relevant considerations. Which data to record, and how, is one of the additional points for consideration in the planning phase. Knowing what needs to be done is to some extent a matter of experience and common sense. Instructors or readers who would like to have more guidance on the subject are referred to the "Action Research Planner" listed on page 123.

The process of action planning was readily demonstrated by this relatively simple example, but it applies equally to more complex situations.

another example

You will, hopefully, be involved in projects like the one outlined below. Notice that it is divided into phases. Activities, categorized by learning domain, are suggested to implement the plan.

Practise is often the only way to determine what works or not, and why. Action planning means finding out through practise how well the activities serve to accomplish the objectives of one phase before going on to the next.

As you read through the following example also note that, no matter how reasonable the original idea seems, the people who implement it and who are supposed to benefit from it must agree and be involved from the very beginning.

Several villages on the periphery of a wildlife refuge are eligible for use rights in the buffer zone of the reserve on the condition that the village plant and maintain a village wood lot for their own needs on severely disturbed sites of the buffer zone. The protected area will supply seedlings as well as fencing and other materials if necessary.

Only the collecting of dead wood is presently allowed in the buffer zone, but, because law enforcement is ineffective, clearing and shifting cultivation are widespread. Firewood is available conveniently and cheaply from the protected area only but without replanting, supplies are likely to run out in less than ten years.

During a series of repeat visits to each village you intend to persuade the people of the advantages of a mutually beneficial agreement. What approach and arguments would you use?

Such actions are usually conceived in an office with the best of intentions and with the firm conviction that they are in the best interest of those they are planned for. Numerous plausible arguments may speak for the intervention but, failure is likely unless plans are written together with the intended beneficiaries.

Action Planning

initial considerations

To become actively involved in the implementation of any program, people must come to "own" the idea behind it. They must recognize the need for action, they must see how they stand to benefit, and they must be able to influence the direction of the project or alter its nature if circumstances so dictate.

If that is the aim, attention must focus on process as much as on product, and action would build on a solid base of common interest and on a clear understanding of village people's needs as articulated by them. Together, alternative solutions should be explored and, only if wood lots are considered viable by the village people themselves, should that solution be pursued.

program phases

The program phases could be as follows:

- Establish a base of common interest between protected area administration and villages, and clarify why action is needed
  a) from the village point of view
  b) from the protected area point of view
- Obtain administrative support for the flexibility which is necessary when decisions about land use in the buffer zone are made in conjunction with the local people. In other words, you need to be certain the administration will back up what you negotiate with the village people.
- Give village people the opportunity to articulate their own needs and propose solutions, and clarify why and how far the proposed solutions can or can not be supported by the administration.
- If the woodlot solution is agreed upon, proceed with the planning and implementation. If an alternative seems more reasonable, submit it to the administration.

activities

The following activities, categorized by learning domain, may be used to implement the preceding action steps:

cognitive

Emphasize the need for action by suggesting an approximate date by which all forest in the buffer zone will have been cut if nothing is done. Supply supporting evidence such as aerial photography or testimony by local people.

Project how much time and labour it will take five years from now to obtain firewood for one family. Describe the drawbacks of using inferior fuels as a substitute. Substantiate projections with local experience of growing inconvenience in procuring firewood.

Explain why the watershed forest has to be maintained and why cutting into the core zone cannot be allowed. Show pictures of erosion and flooding and draw inferences to crop yields and fisheries.

Explain that sustainable use of the buffer zone is in the people's best interest by plausibly demonstrating that the proposed woodlots would indeed be able to satisfy their firewood and timber needs and leave other parts of the buffer zone for collecting of other materials. Support the argument with statements by people who are respected in the community or better, by a trip of village elders to a successfully implemented project of its kind.

affective

Experiment with techniques for how to make administrators empathize with the problems of the village people.

Take selected village elders to villages in the lowlands where people are experiencing the effects of watershed destruction.

Arrange visits of village people from areas with severe firewood shortage to describe their problems.

Discuss the villagers' needs and expectations from the woodlot project. Find out about uncertainties, fears, objections, constraints, and alternatives. Especially encourage them to come up with a satisfactory procedure to distribute responsibilities as well as benefits.

practical

Invite people on a trip to government nurseries to see seedlings and trees, - one, two, five years old. If villagers are unfamiliar with the tree species selected for the wood lot, describe the care it needs, how to recognize signs of disease, and what to do about them. Teach techniques for reducing wood consumption.

Explore methods to hear from those people who are normally inhibited by social conventions from articulating their views, e.g. villagers in the presence of managers, women and children in the presence of men.

Come up with ideas of your own and pick one or a few which seem most worthwhile to pursue, and explore in your mind how you would plan, implement, and evaluate them. The variety of thoughts is usually greater and the exercise is more challenging if this is done in a group. Preparing formal and complex program options which meet the requirements of bureaucracies and funding sources are a natural extension of this process.

suggestions

Trees planted by local people for local people

Now, at the risk of being misunderstood, I will give you the simplest of all possible examples of self-help. The Good Lord has not disinherited any of his children, and, as far as India is concerned. he has given her a variety of trees, unsurpassed anywhere in the world. There are trees for almost all human needs.

One of the greatest teachers of India was the Buddha, who included in his teaching the obligation of every good Buddhist that he should plant and see to the establishment of one tree at least every five years. As long as this was observed, the whole large area of India was covered with trees, free of dust, with plenty of water, plenty of shade, plenty of food and materials.

Just imagine you could establish an ideology which would make it obligatory for every able-bodied person in India, man, woman, and child, to do that little thing - to plant and see to the establishment of one tree a year, five years running. This, in a five year period, would give you 2,000 million established trees.

Anyone can work it out on the back of an envelope that the economic value of such an enterprise, intelligently conducted, would be greater than anything that has ever been promised by any of India's five-year plans.

It could be done without a penny of foreign aid; there is no problem of savings and investment. It would produce foodstuffs, fibres, building material, shade, water, almost anything that man really needs.

I just leave this as a thought, not as the final answer to India's enormous problems.

But I ask: what sort of an education is this if it prevents us from thinking of things ready to be done immediately? What makes us think we need electricity, cement, and steel before we can do anything at all?

The really helpful things will not be done from the centre; they cannot be done by big organisations; but they can be done by the people themselves.

EUGEN SCHUMACHER in
Small is Beautiful

Program Options

what and why of program options

In the previous section we dealt mainly with how you personally plan and implement action. In this section, we offer suggestions for how to present your plans formally for approval.

Having identified problems and relevant target groups, and being familiar with the recurring steps of action planning, you are well into developing feasible program options to submit to your employing agency for approval. In many respects a program option as outlined in this section resembles a proposal outline required by funding agencies. If you seek outside funding, well developed program options form a solid base for the proposal.

The range of options covers programs which ...

- are relatively easily and quickly implemented;
- require some time for preparation;
- require support which at present does not exist;
- offer long term solutions but are costly, time consuming, and subject to numerous constraints and uncertainties.

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components of program options

In a program option you articulate your ideas about how to solve a specific problem. There is no particular magic in the recommended approach except that it draws attention to factors which otherwise you might only discover by trial and error.

The content of the program options can be grouped as shown below.

descriptive title
summary
problem statement
justification
target group
expected results

- What the project is about and why it should be implemented.

objectives
implementation stages
performance criteria
constraints and uncertainties
manpower and budget

- How the program is implemented and how it may cope with constraints and uncertainties.

program content
thrust of argument

- The main message and arguments of the program geared to the target group.

Program Options

The terms "workshop" and "training sessions" will be used interchangeably. The dictionary definition of the former, appropriate in this context, has been given before. Training sessions are similar except that they are closely associated with tangible results for immediate application.

descriptive title

The title should be short and descriptive, and inform about the nature and the purpose of the program.

"Environmental Education for Local People" would be rather too general for a title. The example below is longer but more descriptive.

example

Exploring ways to teach rain forest values and protected area objectives: Three-day workshop and training sessions for secondary school teachers.

summary

The summary should give an indication of expected program results, cost and other requirements, as well as activities associated with its implementation.

example

The proposed option would ensure that at least one teacher in secondary schools of the region is knowledgeable about rain forest values, as well as objectives and educational opportunities at the (name of the reserve). It requires a full time educator in addition to a budget commitment of $7,500 over a period of 21 months to develop a workshop blue print and supplementary teaching materials, and to contact eligible schools and to run the workshops.

problem statement

The problem statement should say what is wrong or inadequate and therefore needs improvement. The statement should suggest a remedy and indicate the urgency of the required action.

example

Most teachers who visit the reserve with their students are unfamiliar with its objectives and with many of the values and internal functions of the rain forest. The trails and animal observation blinds which the reserve maintains at considerable cost are unused and sometimes abused. Training sessions for teachers would result in better preparation of the students for the trip, in a more frequent and more appropriate use of the existing facilities, and ensure that the beneficial role of the rain forest and the protected area is more widely appreciated.

justification

This is the place to cite supporting evidence, e.g. surveys, observations, statistics, etc. and to demonstrate that the proposed action is feasible.

example

Sixty three of 85 teachers questioned expressed their willingness to attend the workshop and make use of supplementary materials in the classroom. Several lecturers at the teachers' college in (name of place) offered assistance with the preparation and distribution of teaching materials to be developed by the program. Overnight accommodation in government guest houses and lecture rooms is available at the reserve.

target group

Target groups must be linked to the proposed solution of the problem. They should not be larger than necessary for an effective solution and should be as precise as necessary and desirable for the purpose. It is sometimes appropriate to distinguish between the total number of people the program is addressed to and the total number the program can be reasonably expected to reach.

example

All 4800 teachers in the 98 secondary schools of the region are potential participants in the workshops, but only between one and three representatives from each school can be admitted to the sessions.

expected results

Reasonable expectations of quantity and quality of results should be stated so that the reward for the funding/supporting agency is obvious. Detailed objectives and performance criteria follow under separate headings.

example

The program is to achieve a better understanding of the rain forest values as well as the reserve's objectives and its educational opportunities. It is expected that teachers who have participated in the workshops will pass their knowledge on to colleagues and students, and that both frequency and efficiency of educational use of facilities at the reserve will improve.

objectives

Objectives must be convincing to the funding source, flexible enough to adjust to reality, and known to and accepted by the people who are affected. To some extent the subject was dealt with in the preceding section, but objectives are so central to any project that the subject is taken up again under a slightly different perspective.

objectives and the target group

If the program option you designed was merely a fine mental exercise which impressed your employer sufficiently to fund it, you might be disappointed before long. Two weeks into program implementation you may realize that nobody cooperates. You try to coerce cooperation and fail. Finally you blame the failure on the stupidity of the "beneficiaries" rather than your own.

To avoid these frustrations, make certain to contact the target group of your proposed program before seriously thinking about implementing it.

As a rule of thumb, always consult those who will be affected by the objectives. Better still, determine the objectives together with them. Never assume that you know what is best for them. Do not even assume that your department knows. This will save you much grief and disappointment.

formulating the objectives

An objective is something to be attained or accomplished as a result of the program. An objective should preferably be expressed in terms which allow us to evaluate whether it has been achieved or not.

The objective "To prevent mining inside the reserve by rallying public opinion" states a clear purpose which is easily evaluated. But if to prevent mining altogether is unlikely to happen even in the wake of a public outcry one could change the objective to "To mitigate impacts or prevent mining in the reserve".

Complex programs may have multiple objectives, and often the question of success or failure cannot be simply answered with yes or no. How much, for instance, does impact have to be mitigated before the objective can be considered attained?

A qualifying statement after the objective can remove the ambiguity, e.g. "Impact mitigation would be considered satisfactory if exploration and exploitation were restricted to the buffer zone".

If an objective is necessarily vague or difficult and expensive to evaluate, you may add success indicators which allow you to state with some confidence that the objective has been achieved. The objective may be, for example, to enhance the habitat value for endangered species of an area by cutting down noise and other disturbances created by visitors. Without reliable data on animal presence before and after the intervention, you would have to measure how visitor behaviour has changed, assuming that endangered species will return to the area as a result.

example

At least one teacher from 60% or more of the schools in the region will participate in the workshop.

Frequency of prearranged visits and quality of education offered during the visits will increase. At least half of the participants will schedule a class visit during the year following the workshop.

Quality of the education will be improved if teachers organize activities for their students before and after each visit.

implementation stages and performance criteria

Most programs are implemented in distinct phases. Complex and long term programs may need performance criteria to monitor progress necessary for good performance at subsequent phases. Implementation stages and associated time schedules should not be understood as rigid, but as subject to change and improvement. Unanticipated events and shortcomings almost always upset original plans and require revisions of intermediate objectives and performance criteria.

(Performance Criteria underlined)

example

Phase One: 4 months

Prepare workshop content and teaching materials in collaboration with teacher college staff.

First edition of materials is completed to the satisfaction of everybody involved in its production; six trial workshops are scheduled for stage two;

Phase Two: 3 months

Do workshop trial runs and revise materials.

Establish a routine for logistics, transportation.

Begin to contact schools.

Revised materials and workshop outline are complete; workshops are scheduled for four to six weeks in advance;

Phase Three: 14 months

Arrange visits to schools which have not responded to mail.

Schedule and conduct workshops on a regular basis.

Explore possibilities of maintaining contact with workshop participants.

Assist visiting groups of earlier workshop participants.

Feedback from workshop participants is positive. Three months after beginning of workshops, scheduled visits from contacted schools increase to at least six per week.

Program Options

uncertainties and constraints

All planning for the future is fraught with uncertainty, and no program is without constraints. In the workshop program you cannot be certain how many of the workshop participants will return with their students. Transportation to some schools could be inconvenient, or regulations might discourage extra-curricular activities, such as a visit to the protected area.

A program to rally public opinion could run into opposition by influential political and economic interests and could be reversed into a campaign against the "anti-development interests".

Foresight and caution are healthy, but a preoccupation with everything that can go wrong could deter from promising innovative approaches. It is not possible to set up contingencies for each and every eventuality, but, if the program seems to stall during implementation, it may be necessary to revise subsequent implementation stages and performance criteria.

example

If a majority of schools does not respond to initial mailings, personal visits will be scheduled between workshops.

The eventual educational use of the reserve could either remain below or exceed expectations. Trends should become noticeable halfway through the second implementation stage. Before school contacts are intensified one should ascertain that insufficient contact indeed causes the shortfall of scheduled visits. In case visits exceed expectations, facilities need to be monitored to see if they can cope with the intensified use.

manpower and budget

An estimate of manpower and budget requirements is needed. Except for very inexpensive options, a detailed account with written estimates should be appended.

One should be explicit about the resources which seem crucial and possibly subject to reneging by the employing agency.

If you are afraid to be given additional assignments before the proposed program is completed, stress the fact that it will occupy all of your time. Also say how much money you need for what purpose and when. Other types of assistance are often required and should be stated.

example

Total budget for 21 month program duration: $7,500.- (includes materials, printing cost, and travel expenses but excludes salaries)

Manpower requirements are one full-time education specialist (21 man/months) and one part time assistant as needed (15 man/months).
The money budget is primarily for the production of teaching materials and to defray cost for workshop participants. Twenty percent of the budget is allocated to travel by the educator.

During the term of the program the educator will be unable to accept additional assignments. After completion of the workshop program, the educator will need to continue to run workshops part-time on a less intensive schedule and provide assistance to the increased number of visiting groups.

program content
thrust of argument

Program content naturally depends on the problem treated and the results one expects. In the program option paper it is only necessary to outline briefly the subject areas one expects to cover.

You want to cover neither more nor less ground than is necessary to achieve your purpose. In the example, knowledge of rain forest functions and values is essential for an understanding of management objectives and education opportunities.

The educator should of course resort to arguments the group is most receptive to and appeal to self interest if at all possible.

example

- *How the rain forest functions.*
- *Values of the rain forest which are compatible and which can be sustained over a long period of time. Values which are not sustainable.*
- *How the protected area benefits the people. Its management objectives and problems.*
- *How to use the protected area best for educational purposes.*

Rain forest values should be presented as relevant to all disciplines. Those ecological and economic benefits should be stressed which most directly affect the workshop participants. Recreational and educational activities should be practised on the site.

Local Action Saves the Lowland Rain Forest of Taman Negara

education, a prerequisite for local action

Will the rain forest as we know it still exist a hundred years from now?

Nobody knows, of course, but there is cause for guarded optimism, because, in some places, people have successfully defended their forests. The rain forest has a future if enough people value its sustainable benefits and are able to muster political power when challenged. Local action is often needed to influence public policy and decision making.

To the educator, years of plodding groundwork may seem to make little difference one way or another, but he is, in fact, building the broad base of support needed for local action. A consciousness of rain forest values emerges gradually, organizations are painstakingly built over the years, and value systems respond slowly to change and education. Yet, once the groundwork has been laid, organized opposition can quickly form against an acute threat, and years of patient effort finally yield visible results.

The following account of opposition to hydro-electric development in the Taman Negara National Park of Malaysia exemplifies how the public can rally in support of the rain forest and save it from destruction. In this case, a broad coalition of citizen groups stood up against the vested interests behind the proposed dam project and won.

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the two sides in the conflict

the government

The Minister of Energy, Datuk Leo Moggie ... categorically stated that the controversial Tembeling project would go on. The Minister stressed that it was the Government's policy to diversify from oil as a source of energy and develop the hydro potential. "As such, the Tembeling Dam is one energy project necessary for us", he said.

New Straits Times, May 1982

the signatories of this Tembeling Declaration

We oppose the proposed Tembeling hydro-electric dam as it will undermine the viability of Taman Negara and will have adverse environmental impacts both on the people and the wildlife in its immediate vicinity. We call upon the Federal Government to permanently abandon this proposal and urge all Malaysians to join our campaign to prevent Taman Negara from becoming Taman Tenaga.*

Malayan Naturalist, August 1982

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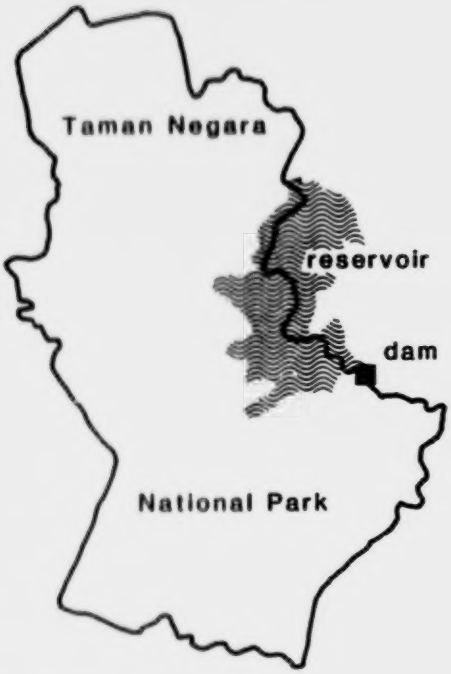
* Misspelling of Taman Negara in a study by the state electricity authority.

Local Action Saves the Lowland Rain Forest of Taman Negara

Taman Negara and the proposed dam



Taman Negara, meaning "national park" in Malay, was established in 1931 as a safe haven for the fauna and flora of peninsular Malaysia. The Tembeling is the major river system of the 4,330 sq.km. park.

A proposed dam and reservoir at Ulu Tembeling would have submerged or otherwise destroyed some 7% of the park's lowland rain forest, home to Orang Asli tribesmen, prime habitat of endangered species, and location of the park's headquarters and tourist facilities.

On the positive side, the dam was expected to generate 110 megawatt of electricity and provide some flood control.

First proposed in 1971, the Tembeling dam was one of the alternatives mentioned in several feasibility studies undertaken in the first half of the seventies. Of six alternatives at least three had fewer constraints and limitations and a greater power generating capacity than the Tembeling dam.

Opposition to the project culminated in a symposium which ...*urged the government to re-examine the Tembeling hydro-electric project in view of the following considerations:*

- *The proposed project will result in the loss of over 259 sq.km. of Taman Negara which*
  (a) is the largest single expanse of protected lowland Dipterocarp forest in Peninsular Malaysia,
  (b) contains the highest concentrations of wildlife, particularly large animals, in the whole of the park.
- *The area of disturbance resulting from the construction of the main and saddle dams is likely to extend to .... the area where all principal park facilities are concentrated.*
- *The destruction of Taman Negara or any part of it will tarnish the good name of Malaysia as a country that values and respects its national heritage.*
- *Alternatives do exist for flood-control and power generation which will not damage our National Park.*

dam plans shelved

In 1978, the government shelved the plans indefinitely without stating any reasons, but in a surprise move, revived them again four years later.

Local Action Saves the Lowland Rain Forest of Taman Negara

dam plans revived

Deputy Prime Minister Datuk Musa Hitam said today ... (that) the National Electricity Board has been directed to resume the (Ulu Tembeling Dam) project which was suspended some time ago for certain reasons.

The Star, January 1982

local action against the dam

The news spurred conservation groups into a flurry of public statements and activities to mobilize grass roots opposition. A fact sheet distributed by the signatories of the Tembeling Declaration presented the objections raised by the 1976 symposium in greater detail.

Aside from the impact on the park, it warned that outside the park 23 sq.km. of rubber, padi, and mixed farmland plus some 100 sq.km. of potential farmland would be flooded. Concern was also expressed for the 800 families, including indigenous tribes, who would be dislocated and face an uncertain future.

The Environmental Protection Society of Malaysia has called for an open public inquiry by the National Electricity Board into two hydro-electric projects. The Society's President, Mr. Gurmit Singh, said an open inquiry, rather than an in-house NEB inquiry, would be in keeping with the "spirit of a people oriented administration".

Sunday Star, February 1982

The Penang branch of the Malayan Nature Society is launching a postcard campaign to appeal to Prime Minister Datuk Sri Dr. Mahathir Mohamad over the proposed dam.

New Straits Times, March 1982

A nation-wide signature campaign urging the government to abandon the controversial Tembeling Dam project kicked off yesterday. A two-man team has started its rounds at Ulu Tembeling, the proposed site...

Malayan Naturalist, November 1982

As a result of the activities and publicity, numerous other citizen groups and associations joined the campaign or endorsed it. Concerned citizens wrote letters to newspapers and prepared statements and speeches.

I must confess to being tired of hearing Datuk Leo Moggie, the Minister of Energy, saying that only three percent of Taman Negara will be affected by the construction of the Tembeling Dam, that only one or two groups are interested in stopping the project, and that he must think of the good of the nation as a whole....

letter to the editor
New Straits Times, May 1982

Gurmit Singh
Environmental Protection Society
Tembeling Controversy Seminar
June 1982

I would like to submit that development cannot be measured by ... the kwh of electricity consumed, the km of roads built, etc. ... Development is more than all these materialistic manifestations. It is finally the ability of an individual to live in harmony with his conscience, his fellow human beings and his natural environment....It is a condition where the individual feels that he belongs, he feels fairly treated, and where his children have a future in a healthy environment.

Such development means a minimization of waste, equity in economic and social facilities, and an exercise of democratic rights. It means among other things the availability of the right amounts and kinds of energy to enable the overall development of the individuals and the community. It does not necessarily mean the drastic increase in the use of electricity.

Kiew Bong Heang
Malayan Nature Society
Tembeling Controversy Seminar
June 1982

Nothing is safe from "development" if the people choose to be apathetic, certainly not the forest reserves which are believed by many to be reserved for their exploitation for economic gain.

dam plans shelved for good

The people were not apathetic, and more than a year of dedicated local action finally paid off.

New Straits Times, January 1983

The controversial Tembeling Dam project in Pahang has been scrapped after years of opposition from conservationists and a widely publicized signature campaign. Deputy Prime Minister Datuk Musa Hitam said in an interview today that the National Action Council decided to drop the plan for a giant hydro-electric power project in the Upper Tembeling river after re-examining the energy needs of the country.

Sunday Star, January 1983

... (the) announcement of the scrapping of the project must have evoked sighs of relief from many quarters - far more, no doubt, than the 34,000 signatories of the Save Taman Negara campaign of recent months.

Not everybody may be able to be in the forefront of local action, but most people can contribute to it on some level. Educators who lay the groundwork have an important job to do.

literature

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